REPORT RESUMES

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AN 8-WEEK SUMMER INSTITUTE TRAINING PROGRAM TO RETRAIN OFFICE EDUCATION TEACHERS FOR TEACHING BUSINESS ELECTRONIC DATA PROCESSING.

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AN INSTITUTE TRAINING PROGRAM WAS DEVELOPED TO AID IN TEACHING METHODS AND CURRICULUMS DEVELOPMENT IN BUSINESS DATA PROCESSING. THIS PROGRAM OFFERED RETRAINING FOR 17 TEACHERS DURING AN 8-WEEK PERIOD. FURTHER DEVELOPMENT WAS INCLUDED FOR COURSE MATERIAL TO USE AS PATTERNS AND GUIDELINES FOR FUTURE PROGRAMS. CLASS OUTLINES WERE DEVELOPED TO BE USED BY STUDENTS IN PROGRAM DEVELOPMENT. (RS)

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AN EIGHT WEEK SUMMER INSTITUTE TRAINING PROGRAM TO RETRAIN OFFICE EDUCATION TEACHERS FOR TEACHING BUSINESS ELECTRONIC DATA PROCESSING

Principal Investigator

Theodore A. Koschler

Miami-Dade Junior College
Miami, Florida

Vocational and Technical Education Grant
Contract No. OE-5-85-098
Vocational Education Act of 1963, Section 4(c)

Project Dates
June 21, 1965 thru August 13, 1965

The Project reported herein was supported by a Grant from the U. S. Department of Health, Education, and Welfare, Office of Education.

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PROJECT

The impact of modern electronic data processing methods upon both the educational and administrative areas of the country's Universities, Colleges, Junior Colleges, and High Schools is reflected in the following ways:

1. Instruction of both scientific and business students in electronic data processing has been started from the high school level through the universities.
2. The practical requirement of processing large volumes of data and calculations places an educational burden upon the school system to provide student training in today's method of handling this gigantic problem.
3. The sheer numbers of school enrollments practically forces the educational administrator to examine new methods for keeping up with the swelling student population and its compounding problems.

The responsibility of meeting this new student need falls squarely upon the school systems. Training can be divided into two general areas: business and scientific.

Students in both of these fields need to know what electronic data processing can do for them in their particular areas. Therefore, one of the minimum graduation requirements in several well known colleges and universities is an EDP Survey Course. Other schools, such as West Point, are requiring actual student use of a computer before graduation is permitted.

Though all students do not need to be able to manipulate the equipment, many people can be gainfully employed in the direct support of EDP installations. Training of these technicians can be economically supported by the school systems. However, the knowledge base required in this area is becoming so wide spread and complex that it is now almost impossible to provide adequate instruction in a two-year terminal Junior College Program. One solution to this is to start the training in the high schools and to continue it at the junior college level. Further training in the area of a Computer Systems Analysis could be provided by the senior institutions to meet the need of industry for persons trained to investigate and establish totally integrated computer systems.

OBJECTIVES

The major objective of the institute was to assist in the development of the knowledge and skill essential for teaching specialized courses in preparatory curriculums in business electronic data processing under Federally supported Vocational and Technical Education Acts.

There is an acute shortage of teachers for business data processing involving the use of computers and peripheral equipment. Since regular pre-service teacher education programs have not been developed in this newly emerged field of instruction, the Summer Institute program was initiated in an effort to meet the nation-wide demand for teachers. Miami-Dade Junior College is one of five schools conducting these institutes; the others are as follows: Orange Coast College, Costa Mesa, California; Colorado State University, Fort Collins, Colorado; Holding Technical Institute, Raleigh, North Carolina; and Milwaukee Institute of Technology, Milwaukee, Wisconsin.

This institute had at least these specific objectives.

1. To retrain teachers with a minimum of three years teaching experience in business or office education for teaching of newly emerged business electronic data processing, including computer programming.

2. To further develop suggested course material -- including course content, references, visual and other instructional aids -- suitable for use as patterns and guidelines for future programs.

PROCEDURE

The institute will consist of first and second year courses with the content designed specifically to meet the needs of our participants in the subject areas of Introduction to Business Data Processing, Electronic Accounting Machines, Data Processing Applications, Computer Programming I, Computer Programming II, Programming Systems, Business Systems Design and Development, and Advanced Programming System.

In addition to emphasis on electronic data processing, seminars will be held to discuss the philosophy and principles of vocational education. College credit, either at the graduate or undergraduate level, may be awarded upon successful completion of the eight-week program.

Separate classes will be conducted in each of the institutes for First Year participants and for Second Year enrollees. Instructional procedures for both groups will include the following:

Lecture

Lecture-laboratory

Actual work on equipment

Observation of data processing procedures in business

Wiring of programs

Writing programs

Committee work

Oral and written reports

Discussion sessions

Seminars

A brief description of the courses are listed as follows:

A. FIRST YEAR PARTICIPANTS

1. Introduction to Business Data Processing:

   Study of the development of Computer Systems from manual methods to stored programs. Designed to provide a foundation for detailed study of specific systems.

2. Electronic Accounting Machines:

   A survey of electric accounting machines, illustrating the need for machines in accounting and record keeping and the concept, power, and flexibility of the unit record. The importance and scope of unit record equipment as an independent system will be developed throughout the course. Laboratory exercises will be executed, including planning and wiring a range of unit record equipment. Practical exercises offered will be typical of those performed in the existing electric accounting machine installations.

3. Data Processing Applications:

   Designed to acquaint the participant with business data processing applications; practical case studies illustrate the use of data processing equipment in various types and sizes of representative companies.

4. Computer Programming 1:

   Consideration of the function and capabilities of a specific data processing machine and the tools and raw materials necessary for becoming a programmer.

Participants will perform programming drills, exercises, and case studies which will serve to bridge the gap from the theoretical to the real world of data processing.

5. Philosophy of Vocational Education:

   An appreciation of the social and economic values of all forms of vocational education in our democracy and the provisions for vocational education in our educational system.

B. SECOND YEAR PARTICIPANTS

1. Computer Programming 2:

   A continuation of Computer Programming 1. The principles presented in the first-year course will be employed repeatedly. Programming the tape data processing system will be taught, as well as the fundamentals of random access programming.

2. Programming Systems:

   An introduction to programming systems to familiarize the student with the purpose and function of the various types of systems.

3. Business Systems Design and Development:

   Designed to guide the student through the three stages in the evolution of a system: analysis of present information flow; system specifications and equipment selections; and implementation of the system.

4. Advanced Programming Systems:

   Efforts will be made to provide the student with sufficient knowledge of programming systems concepts so that he can master any specific system with a minimum of instruction. Furthermore, he should be qualified to analyze, evaluate, and make minor modifications to such systems.

III. Schedule:

Students will attend classes for seven hours per day for a total of 280 hours per the eight weeks.

Hours per course are scheduled as follows:

FIRST YEAR	Classroom	Lab
A. Introduction to Data Processing	40	--
B. Electronic Accounting Machines	60	40
C. Data Processing Applications	20	20
D. Computer Programming 1	40	60
E. Philosophy of Vocational Education	8	--
TOTAL	168	120

SECOND YEAR		
A. Computer Programming 2	20	20
B. Programming Systems	30	30
C. Business Systems Design and Development	30	30
D. Advanced Programming Systems	40	40
TOTAL	120	120

RESULTS/CONCLUSION

The two basic objectives of the institute were completed. Seventeen teachers received training in the field of electronic data processing and many are now actively working in the field. Class outlines were developed during the institute to provide basic groundwork for the student to develop local data processing programs.

The time period of eight weeks was not sufficient to train an individual in all areas of EDP adequately. The basic knowledge required was covered, but continued study, both formal and informal, was recommended.

IMPLICATIONS

Many facets of educational electronic data processing need further exploration. These can be divided into two general categories: technological and administrative.

Some of the technological problems considered were:

1. EQUIPMENT -- types and costs
2. SOFTWARE -- uses and availability
3. FACILITIES -- physical requirements
4. COMPETENCE -- technical developments

Examples of the administrative problem areas encountered were:

1. Application for government grants
2. Educational EDP applications
    - INSTRUCTIONAL
    - ADMINISTRATIVE
3. Instructional personnel requirements
4. Student testing requirements for admission to curriculum
5. Certification of high school teacher in EDP
6. Definition of roles of high school, junior college, and university in EDP education
7. Summary of schools offering EDP courses and degrees

The class consensus affirmed a need for future summer institute work. This need stems from the rapid technological advances in the EDP fields, the size and complexity of knowledge needed to function in the area, and the relatively short-time period of the institute.

MIAMI-DADE JUNIOR COLLEGE

11380 NORTHWEST 27 AVENUE

MIAMI, FLORIDA 33167

BUSINESS DATA PROCESSING TEACHER EDUCATION

TRAINING PROGRAM

DAILY CLASS SCHEDULE

JUNE 21, 1965 - AUGUST 13, 1965

FIRST AND SECOND YEAR PROGRAMS

MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: First **Daily Class Schedule** **First Year**

LABORATORY

LECTURE

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
A.M.	June 21	June 22	June 23	June 24	June 25
8:30-10:00 Unit Record and Systems	Orientation	Systems Lab	Demonstration	Systems Lab	Program Card Exercise
10:00-11:30 Computer	Demonstration	Computer Lab	Computer Lab	Philosophy of Technical Education	Computer Lab
11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
12:30-2:30 Unit Record and Systems	Introduction to Punched Card Terms and Concepts	Introduction Systems Functions Concepts Programs	Card Punch	Survey Fact Gathering Charting Symbols Charts	Sorter
2:30-4:30 Computer	Demonstration Problem Amortization Schedule and Introduction to the IBM 1620	Storage Organization Number Representation	Instruction Format Read Numeric Write Numeric Branch	Read Numeric Write Numeric Branch (continued)	Read Alphameric Write Alphameric Branch

June 11, 1965 JAD:pm

MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Second

Daily Class Schedule

First Year

	TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	A.M.	June 28	June 29	June 30	July 1	July 2
LABORATORY	8:30-10:00	Sorter Exercises	Systems Lab	Test #1; IBM Card, Card Punch, Sorter, 557 Exercises 1-4	Burroughs Information Seminar	557 Exercises 5-8
	10:00-11:30	Computer Lab	Computer Lab	Computer Lab	Computer Lab	Computer Lab
	11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
LECTURE	12:30-2:30	Office Layout Systems Analysis	Functional Wiring Principles 557 pp 2-7 Printing Zero Print Control	557 pp 5-11 Column Splits and X-Elimination	Selling Systems Installation and Follow up	557 pp 11-16 Class Selection
	2:30-4:30	Input-Output Typewriter Papertape Printer	Gangpunching	Reproduce with halt on last card	Gangpunching under switch control and under counter control'	Loader for entering program at other than zero

June 11, 1965

JAD:pm

MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Third **Daily Class Schedule** **First Year**

LABORATORY

LECTURE

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
A.M.	July 5	July 6	July 7	July 8	July 9
8:30-10:00	HOLIDAY	Systems Lab	557 Exercises 9-12	National Cash Register Corporation Information Seminar	557 Exercises 13-16
10:00-11:30		Computer Lab	Computer Lab	Computer Lab	Computer Lab
11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
12:30-2:30		Systems Manuals	557 pp 16-20 Field Selection Suppress Print	Forms Analysis and Design	557 Test #2
2:30-4:30		Add two numbers and punch numerically	SPS (Card) Gang-punching under counter control	SPS (Monitor) Operating procedure	Pay calculation in SPS

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MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Fourth

Daily Class Schedule

First Year

	TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	A.M.	July 12	July 13	July 14	July 15	July 16
LABORATORY	8:30-10:00	Finish 557 Exercises 519 Features	Systems Lab	519 Exercises 1-6	IBM Information Seminar	Eastern Airlines Tour
	10:00-11:30	Computer Lab	Computer Lab	Fortran Lab	Fortran Lab	Eastern Airlines Tour
	11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
LECTURE	12:30-2:30	519 pp 28-31 Punching Methods Gangpunching	Work Measurement	519 pp 29-36 Intersperse Gangpunching Punch Normal - Punch Transfer Method	Forms Administration Records Management	519 pp 36-44 I.G.P. Punch Direct Method Reproduce and Compare
	2:30-4:30	Pay Calculations in SPS (continued)	Begin two weeks of Fortran Introduction Fixed and Floating Numbers and Variables	Read and Write Cards Typewriter Printer	Punch under switch control	Arithmetic Statements

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JAD:pm

MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Fifth

Daily Class Schedule

First Year

LABORATORY

LECTURE

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
A.M.	July 19	July 20	July 21	July 22	July 23
8:30-10:00	519 Exercises 7-15	Fortran Lab	519 Exercises 16-21	Univac-Sperry Rand Information Seminar	Test #3 519
10:00-11:30	Fortran Lab	Fortran Lab	Fortran Lab	Philosophy of Technical Education	Fortran Lab
11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
12:30-2:30	519 pp 44-50 Offset reproduce and compare Selective reproduce and compare	Office tools Preparation Communication Handling and Storage	519 pp 47-62 X-Elimination Emitting Field Selected Rep. End Printing Mark Sensing	Keyboard Accounting Machines Peripheral Devices	077 Collator Features pp 73-79 Force Feeding X-Selection
2:30-4:30	Payroll Problems	Expanded Payroll Problem	Expanded Payroll Problem (continued)	Subscripted Variables	Problem: Sum of each student's grades

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MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Sixth

Daily Class Schedule

First Year

	TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	A.M.	July 26	July 27	July 28	July 29	July 30
LABORATORY	8:30-10:00	Finish 519 Exercises 077 Features 077 Exercises 1-3	RCA Information Seminar	077 Exercises 4-8	Review Punched Card Machines	Review Punched Card Machines
	10:00-11:30	Fortran Lab	Fortran Lab	1401 Computer Principles of Tape Oriented Processing System	1401 Computer Demonstration	Central Data Processing Services to Dade County Public Schools
	11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
LECTURE	12:30-2:30	077 pp 79-84 Sequence Checking	077 pp 84-88 Merging Basic Set-up Switches	System/360 Introductory Notes Film Binary vs. BCD Computers	System/360 Operating System	System/360 Communications Systems
	2:30-4:30	Problem: Sum of each student's grades (continued)	Begin two weeks of Cobol Introduction Cobol Divisions Operating Systems Data Division Format	System/360 Monitor System	System/360 Teleprocessing	System/360 Mass Storage Media I/O Devices

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MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Seventh

Daily Class Schedule

First Year

	TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	A.M.	August 2	August 3	August 4	August 5	August 6
LABORATORY	8:30-10:00	077 Exercises 9-12	University of Miami Tour	077 Exercises 13-20	Royal McBee Information Seminar	077 Exercises 21-26
	10:00-11:30	Cobol Lab	University of Miami Tour	Cobol Lab	Cobol Lab	Cobol Lab
	11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
LECTURE	12:30-2:30	077 pp 89-93 Merging with Selection Matching	EDP Feasibility and Installation System Software and Equipment Installation	077 pp 94-109 Selection of Card Groups	Information Systems Retrieval	077 Collator Test #4
	2:30-4:30	Problem 1 Data Division Picture Clause Size - Class Cobol Verbs Open, move, read, add, write, close Constants	Problem 2 Page Headings If Statement	Problem 3 Comparing Minor Totals Switch Setting	Problem 4 Group Printing Problem 5 Multiple Files Renaming Option Card Counting	Problem 5 (continued)

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MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Eighth

Daily Class Schedule

First Year

	TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	A.M.	August 9	August 10	August 11	August 12	August 13
LABORATORY	8:30-10:00	407 Accounting Machine Features Detail Printing	Systems Lab	407 Exercises 1-4	Control Data Corp. Information Seminar	Planning a computer center and curriculum
	10:00-11:30	Cobol Lab	Cobol Lab	Cobol Lab	Planning a computer center and curriculum	Staff-Student Conference Dismissal
	11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
LECTURE	12:30-2:30	407 Accounting Machine Addition Zero Print Control	Comparison of a payroll application on various types of equipment EDP Applications	407 Test #5 Wiring Diagram only	Systems Planning and Control PERT - A technique for program planning and control	
	2:30-4:30	Problem 6 Multiple Input Card Formats	Problem 7 Group Printing Minor & Intermediate Totals	Question and Problem Session Review for Test	Cobol Exam	

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MIAMI-DADE JUNIOR COLLEGE
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BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: First

Daily Class Schedule

Second Year

	TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	A.M.	June 21	June 22	June 23	June 24	June 25
LABORATORY	8:30-10:00 Computer	Orientation	Computer Lab	Computer Lab	Computer Lab	Computer Lab
	10:00-11:30 Term Problem	Term Problem	Systems Lab	Term Problem	Philosophy of Technical Education	Term Problem
	11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
LECTURE	12:30-2:30	Review: Storage Organization Instruction Format	Introduction Systems Functions Concepts Programs	Review: SPS - Gangpunching Program under counter control	Survey Fact Gathering Charting Symbols Charts	Monitor: SPS - Crossfooting
	2:30-4:30	Project Development Self-Study or Laboratory	Project Development Self-Study or Laboratory	Project Development Self-Study or Laboratory	Project Development Self-Study or Laboratory	Project Development Self-Study or Laboratory

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MIAMI-DADE JUNIOR COLLEGE
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BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Second

Daily Class Schedule

Second Year

	TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	A.M.	June 28	June 29	June 30	July 1	July 2
LABORATORY	8:30-10:00	Computer Lab	Computer Lab	Computer Lab	Burroughs Information Seminar	Computer Lab
	10:00-11:30	Term Problem	Systems Lab	Term Problem	Systems Lab	Term Problem
	11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
LECTURE	12:30-2:30	Office Layout Systems Analysis	Fortran Crossfooting	Monitor Utility Programs	Selling Systems Installation and Follow Up	Mass Storage Tape Disk - Write Card to disk in machine language Data Cell
	2:30-4:30	Project Development Self-Study or Laboratory	Project Development Self-Study or Laboratory	Project Development Self-Study or Laboratory	Project Development Self-Study or Laboratory	Project Development Self-Study or Laboratory

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MIAMI-DADE JUNIOR COLLEGE
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BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Third

Daily Class Schedule

Second Year

LABORATORY

LECTURE

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
A.M.	July 5	July 6	July 7	July 8	July 9
8:30-10:00	HOLIDAY	Computer Lab	Computer Lab	National Cash Register Corp. Information Seminar	Computer Lab
10:00-11:30		Systems Lab	Term Problem	Systems Lab	Term Problem
11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
12:30-2:30		Systems Manual	Software I/O Sort-Merge	Forms Analysis and Designs	Problem Review
2:30-4:30		Project Development Self-Study or Laboratory	Project Development Self-Study or Laboratory	Project Development Self-Study or Laboratory	Project Development Self-Study or Laboratory

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MIAMI-DADE JUNIOR COLLEGE
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BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Fourth

Daily Class Schedule

Second Year

	TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	A.M.	July 12	July 13	July 14	July 15	July 16
LABORATORY	8:30-10:00	Computer Lab	Computer Lab	Fortran Lab	IBM Information Seminar	Eastern Airlines Tour
	10:00-11:30	Term Problem	Systems Lab	Term Problem	Systems Lab	Eastern Airlines Tour
	11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
LECTURE	12:30-2:30	Problem Review	Work Measurement	System/360 Introductory Notes Film	Forms Administration Records Management	System/360 Description of Core and Its Implications
	2:30-4:30	Project Development Self-Study or Laboratory	Begin two weeks of Fortran Introduction Fixed and Floating Numbers and Variables	Read and Write Cards Typewriter Printer	Punch under switch control	Arithmetic Statements

June 11, 1965

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MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Fifth

Daily Class Schedule

Second Year

	TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	A.M.	July 19	July 20	July 21	July 22	July 23
LABORATORY	8:30-10:00	Fortran Lab	Fortran Lab	Fortran Lab	Univac-Sperry Rand Information Seminar	Fortran Lab
	10:00-11:30	Term Problem	Systems Lab	Term Problem	Philosophy of Technical Education	Term Problem
	11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
LECTURE	12:30-2:30	System/360 Numbering Systems Decimal Octal Binary Hexadecimal Fixed and Floating Point Numbers	Office tools Preparation Communication Handling and Storage	System/360 Basic Assembly Language Programming	Keyboard Accounting Machines Peripheral Devices	System/360 Basic Operating System
	2:30-4:30	Payroll Problems	Expanded Payroll Problem	Expanded Payroll Problem (continued)	Subscripted Variables	Problem: Sum of each student's grades

June 11, 1965

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MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Sixth

Daily Class Schedule

Second Year

	TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	A.M.	July 26	July 27	July 28	July 29	July 30
LABORATORY	8:30-10:00	Fortran Lab	RCA Information Seminar	Analysis of a Functioning System at an EDP Installation	Analysis of a Functioning System at an EDP Installation	Analysis of a Functioning System at an EDP Installation
	10:00-11:30	Term Problem	Term Problem	Analysis of a Functioning System at an EDP Installation	Analysis of a Functioning System at an EDP Installation	Analysis of a Functioning System at an EDP Installation
	11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
LECTURE	12:30-2:30	1401 Programming Languages	1401 Tape Sorting Program	Analysis of a Functioning System at an EDP Installation	Analysis of a Functioning System at an EDP Installation	Analysis of a Functioning System at an EDP Installation
	2:30-4:30	Problem: Sum of each student's grades (continued)	Begin two weeks of Cobol Introduction Cobol Divisions Operating System Data Division Format	Analysis of a Functioning System at an EDP Installation	Analysis of a Functioning System at an EDP Installation	Analysis of a Functioning System at an EDP Installation

June 11, 1965

JAD:pm

MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Seventh

Daily Class Schedule

Second Year

LABORATORY

LECTURE

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
A.M.	August 2	August 3	August 4	August 5	August 6
8:30-10:00	Cobol Lab	University of Miami Tour	Cobol Lab	Royal McBee Information Seminar	Cobol Lab
10:00-11:30	Term Problem	University of Miami Tour	Term Problem	Systems Lab	Term Problem
11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
12:30-2:30	Project Development Self-Study or Laboratory	EDP Feasibility and Installation System Software and Equipment Installation	Project Development Self-Study or Laboratory	Information Systems Retrieval	Project Development Self-Study or Laboratory
2:30-4:30	Problem 1 Date Division Picture Clause Size - Class Cobol Verbs Open, move, read, add, write, close Constants	Problem 2 Page Headings If Statement	Problem 3 Comparing Minor Totals Switch Setting	Problem 4 Group Printing Problem 5 Multiple Files Renaming Option Card Counting	Problem 5 (continued)

June 11, 1965

JAD:pm

MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER

BUSINESS DATA PROCESSING SUMMER INSTITUTE

Week: Eighth

Daily Class Schedule

Second Year

	TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
	A.M.	August 9	August 10	August 11	August 12	August 13
LABORATORY	8:30-10:00	Cobol Lab	Cobol Lab	Cobol Lab	Control Data Corp. Information Seminar	Planning a computer center and curriculum
	10:00-11:30	Term Problem	Systems Lab	Term Problem	Planning a computer center and curriculum	Staff-Student Conference
	11:30-12:30	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
LECTURE	12:30-2:30	Project Development Self-Study or Laboratory	Comparison of a payroll application on various types of equipment EDP Applications	Project Development Self-Study or Laboratory	Systems Planning and Control PERT - A technique for program planning and control	
	2:30-4:30	Problem 6 Multiple Input Card Formats	Problem 7 Group Printing Minor and Intermediate Totals	Question and Problems Session Review for Test	Cobol Exam	

June 11, 1965

JAD:pm

1965 SUMMER INSTITUTE DAILY CLASS OUTLINES

MIAMI-DADE JUNIOR COLLEGE
11380 NORTHWEST 27TH AVENUE
MIAMI, FLORIDA 33167

BUSINESS DATA PROCESSING TEACHER EDUCATION TRAINING PROGRAM

DAILY CLASS OUTLINES

JUNE 21, 1965 - AUGUST 13, 1965

FIRST YEAR JUNE 21, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO INTRODUCE THE BASIC CONCEPTS OF PUNCHED CARD DATA PROCESSING AND ITS TERMINOLOGY

1. HOLLERITH CODE
    - NUMERIC CHARACTERS
    - ALPHABETIC CHARACTERS
    - SPECIAL CHARACTERS
2. FIELDS
3. BASIC TYPES OF CARDS
    - TRANSCRIPTS
    - DUAL
    - MARK SENSE
    - SUMMARY
4. CODING METHODS

PROJECT INTERPRET MANUALLY A CARD PREPUNCHED WITH ALPHABETIC AND SPECIAL CHARACTERS.

REFERENCE OPERATORS GUIDE, P. 9

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FIRST YEAR JUNE 23, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE MANUAL AND AUTOMATIC FEATURES OF THE KEYPUNCH

1. EXTERNAL FEATURES
2. KEYBOARD
3. PROGRAM CARD
4. SPEED OF MACHINE
5. KEYBOARD LOCKING

PROJECT COMPLETE THE ASSIGNED PROGRAM CARD EXERCISES

REFERENCE OPERATORS GUIDE, PP 8-24, 024-026
KEYPUNCH REFERENCE MANUAL, A24-0520

****

FIRST YEAR JUNE 25, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO STUDY THE METHOD THROUGH WHICH THE SORTER IS USED TO ARRANGE CARDS IN THE DESIRED ORDER

1. TYPES OF SORTING
2. MACHINE FEATURES
3. OPERATING PRINCIPLES
4. NUMERIC SORTING
5. ALPHABETIC SORTING

6. SELECTION SWITCHES
7. BLOCK SORTING
8. CONTROL SORTING (MULTIPLE CONTROL FIELDS)

PROJECT EQUIPMENT FAMILIARIZATION DURING LABORATORY PERIOD

REFERENCE OP. GUIDE, PP 30-37

****

FIRST YEAR JUNE 29, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO STUDY THE EXTERNAL FEATURES OF THE 557 INTERPRETER

1. MACHINE FEATURES
2. OPERATING KEYS AND LIGHTS
3. PRINT UNIT

PROJECT EQUIPMENT FAMILIARIZATION DURING LABORATORY PERIOD

REFERENCE OP. GUIDE, PP 123-126

OBJECTIVE TO LEARN THE FUNDAMENTALS OF WIRING IBM CONTROL PANELS

1. HUBS
    - ENTRY
    - EXIT
    - COMMON
    - BUS
2. WIRING DIAGRAMS
    - PURPOSE
    - METHODS OF REPRESENTATION
3. CYCLES

PROJECT NONE

REFERENCE FWP, PP 1-13, 18-19

OBJECTIVE TO LEARN THE PRINCIPLES OF WIRING THE FOLLOWING OPERATIONS ON THE 557 INTERPRETER

1. NORMAL PRINTING
2. ZERO PRINT CONTROL

PROJECT DIAGRAM AND TEST WIRING FOR PROBLEMS 1-4, QUESTIONS 1-8, P 21, 557 TEXT

REFERENCE FWP, PP 18-19, PP 134-136, 557 TEXT, PP 1-7

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FIRST YEAR JUNE 30, 1965 830-1000 MR. DUERSTOCK

OBJECTIVE TEST COVERING THE FOLLOWING SUBJECTS

1. HOLLERITH CODE
2. 026 CARD PUNCH
3. 082 SORTER
4. TERMINOLOGY
5. BASIC PUNCHED CARD CONCEPTS

PROJECT NONE

REFERENCE OPERATORS GUIDE, PP 1-44

****

FIRST YEAR JUNE 30, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE PRINCIPLES OF WIRING THE FOLLOWING OPERATIONS ON THE 557 INTERPRETER

1. CONTROL PUNCHES
2. X ELIMINATION
3. COLUMN SPLITS
    - INTERNAL CONNECTIONS
    - ARMATURE

PROJECT DIAGRAM AND TEST WIRING FOR PROBLEMS 5-8, QUESTIONS 9-14, P 21, 557 TEXT

REFERENCE 557 TEXT, PP 7-9

****

FIRST YEAR JULY 2, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE PRINCIPLES OF WIRING THE FOLLOWING OPERATIONS ON THE 557 INTERPRETER

1. SELECTORS
    - CYCLES
    - TIMING
    - PICKUP HUBS
2. CLASS SELECTION
    - DEFINITION
    - WIRING EXAMPLE

PROJECT DIAGRAM AND TEST WIRING FOR PROBLEMS 9-12 QUESTIONS 15-18, P 21, 557 TEXT

REFERENCE 557 TEXT, PP 9-16, 557 REFERENCE MANUAL, A24-0516

****

FIRST YEAR JULY 7, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE PRINCIPLES OF WIRING THE FOLLOWING OPERATIONS ON THE 557 INTERPRETER

1. FIELD SELECTION
2. SUPPRESS PRINT

PROJECT DIAGRAM AND TEST WIRING FOR PROBLEMS 13-16
QUESTIONS 19-21,24,27, P 21, 557 TEXT

REFERENCE 557 TEXT, PP 16-19

****

FIRST YEAR JULY 9, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TEST COVERING WIRING OF 557 INTERPRETER

1. MULTIPLE CHOICE QUESTIONS
2. WIRING DIAGRAMS

PROJECT NONE

REFERENCE OPERATORS GUIDE, PP 117-126
557 TEXT, PP 1-26

FIRST YEAR JULY 12, 1964 0830-1000 MRS. THORPE

OBJECTIVE TO LEARN THE EXTERNAL FEATURES OF THE 519 DOCUMENT ORIGINATING MACHINE

1. MACHINE FEATURES
    - READ FEED
    - PUNCH FEED
    - COMPARING UNIT
    - X-BRUSHES
    - END PRINTING
2. MACHINE FUNCTIONS
    - GANGPUNCHING
    - REPRODUCE
    - COMPARE
    - SUMMARY PUNCHING
    - MARK SENSING

PROJECT EQUIPMENT FAMILIARIZATION DURING LABORATORY PERIOD

REFERENCE OPERATORS GUIDE, PP 101-108

****

FIRST YEAR JULY 12, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE EXTERNAL FEATURES OF THE 519 DOCUMENT ORIGINATING MACHINE AND TO UNDERSTAND THE THEORY OF EACH MAJOR OPERATION

1. OPERATING KEY AND SWITCHES
2. SIGNAL LIGHTS
3. COMPARING UNIT
4. CONTROL PANEL
5. SUMMARY PUNCHING
6. READ UNIT
7. PUNCH UNIT
8. TYPICAL OPERATIONS

PROJECT EQUIPMENT FAMILIARIZATION DURING LABORATORY PERIOD

REFERENCE OP. GUIDE, PP 101-108

OBJECTIVE TO LEARN THE WIRING OF THE FOLLOWING OPERATIONS ON THE 519

1. GANGPUNCHING
2. INTERSPERSE GANGPUNCHING (PUNCH TRANSFER METHOD)

PROJECT DIAGRAM AND TEST WIRING PROBLEMS 1-2
QUESTIONS 1-5, 519 TEXT

REFERENCE 519 REFERENCE MANUAL, A24-1017
519 TEXT, PP 28-36

****

FIRST YEAR JULY 14, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE PUNCH NORMAL-PUNCH TRANSFER METHOD OF INTERSPERSE GANGPUNCHING

1. CONTROL PUNCHES
2. FUNCTION OF PX BRUSH
3. INTERSPERSE GANGPUNCHING
    - MASTER CARD
    - DETAIL CARD
4. PUNCH ENTRY SCHEMATIC
5. COMPARING
    - COMPARING UNIT
    - FUNCTION OF RX BRUSH
    - COMPARE SWITCH

PROJECT DIAGRAM AND TEST WIRING PROBLEMS 3-6
QUESTIONS 6-16, 519 TEXT

REFERENCE 519 TEXT, PP 29-36

****

FIRST YEAR JULY 16, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE PUNCH DIRECT METHOD OF REPRODUCING AND COMPARING

1. PROBLEM DEFINITION
2. WIRING FORMULA
    - REPRODUCING
    - COMPARING
3. REPRODUCE SWITCH
4. PUNCH DIRECT ENTRY

PROJECT DIAGRAM AND TEST WIRING PROBLEMS 10-14
QUESTIONS 21-26, 519 TEXT

REFERENCE 519 TEXT, PP 40-43

****

FIRST YEAR JULY 19, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN OFFSET AND SELECTIVE REPRODUCING

1. OFFSET REPRODUCING
    - PROBLEM DEFINITION
    - DATA LOCATION IN ORIGINAL CARD
    - DATA LOCATION IN NEW CARD
2. SELECTIVE REPRODUCING
    - PROBLEM DEFINITION
    - SUSPENSION OF PUNCHING
    - SUSPENSION OF COMPARING
    - READ DELAY

PROJECT DIAGRAM AND TEST WIRING PROBLEMS 14-16, 19-21

REFERENCE 519 TEXT, PP 44-50

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FIRST YEAR JULY 21, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE PRINCIPLES OF WIRING THE FOLLOWING OPERATIONS ON THE 519

1. X-ELIMINATION
2. EMITTING
    - PUNCH EMITTER
    - X + 0 EMITTER

3. END PRINTING
4. MARK SENSING
5. FIELD SELECTED REPRODUCING

PROJECT DIAGRAM AND TEST WIRING PROBLEMS 23, 25-26, 31-33

REFERENCE 519 TEXT, PP 50-61

* * *

FIRST YEAR JULY 23, 1965 830-1000 MR. DUERSTOCK

OBJECTIVE TEST COVERING WIRING OF 519 DOCUMENT ORIGINATING MACHINE

1. MULTIPLE CHOICE QUESTIONS
2. WIRING DIAGRAMS

PROJECT NONE

REFERENCE OPERATORS GUIDE, PP 101-108
519 TEST, 28-71

* * *

FIRST YEAR JULY 23, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO STUDY THE EXTERNAL FEATURES OF THE 077 COLLATOR

1. MACHINE FEATURES
    - HOPPERS
    - STACKERS
2. MACHINE FUNCTIONS
    - SEQUENCE CHECKING
    - SELECTING
    - MERGING
    - MATCHING
3. OPERATING KEYS AND LIGHTS

PROJECT EQUIPMENT FAMILIARIZATION DURING LAB PERIOD

REFERENCE OPERATORS GUIDE, P 45-49

OBJECTIVE TO LEARN THE PRINCIPLES OF WIRING THE FOLLOWING OPERATIONS ON THE 077 COLLATOR

1. FORCE FEEDING
    - PLUG TO C
    - PRIMARY FEED
    - SECONDARY FEED
2. X-SELECTION
    - PRIMARY FEED
    - SECONDARY FEED
    - HOLD CIRCUITS

X-SELECTOR

PROJECT DIAGRAM AND TEST WIRING PROBLEMS 1-3
QUESTIONS 1-7, P 110, 077 TEXT

REFERENCE 077 TEXT, PP 73-79

****

FIRST YEAR JULY 26, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE PRINCIPLES OF SEQUENCE CHECKING ON THE 077 COLLATOR

1. RANDOM VS SEQUENTIAL PROCESSING
2. THE SEQUENCE UNIT
    - CHECKING METHOD
    - AVAILABLE RESULTS
3. CONTROL PANEL HUBS
    - PRIMARY READ BRUSHES
    - PRIMARY SEQUENCE READ BRUSHES
    - PS, PS1, PS2
    - RESTORE
    - ERROR STOP
4. ANALYSIS CHARTS
5. SEQUENCE CHECKING MULTIPLE FIELDS

PROJECT DIAGRAM AND TEST WIRING PROBLEMS 4-8
QUESTIONS 8-14, P 110, 077 TEXT

REFERENCE 077 TEXT, PP 79-84

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FIRST JULY 27, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE PRINCIPLES OF MERGING ON THE 077 COLLATOR

1. MERGING ANALYSIS CHARTS
2. BASIC SETUP SWITCHES
    - FUNCTIONS
    - RESULTS IF WIRED ON
    - SECONDARY FEED
    - EJECT
    - PRIMARY FEED
    - MULTIPLE S AND S
    - PRIMARY CHANGE
    - INTERLOCK
3. CONTROL PANEL HUBS
    - PRIMARY SELECTOR ENTRY
    - SECONDARY SELECTOR ENTRY
    - SEL, S, P
    - SECONDARY READ BRUSHES
4. RELATIONSHIP BETWEEN THE BASIC SETUP SWITCHES AND THE

CTRL INPUTS

PROJECT DIAGRAM AND TEST WIRING PROBLEMS 9-12
QUESTIONS 15-19, P 110, 077 TEXT

REFERENCE 077 TEXT, PP 84-88

* * *

FIRST YEAR AUGUST 2, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE PRINCIPLES OF WIRING THE FOLLOWING OPERATIONS ON THE 077 COLLATOR

1. MERGING WITH SELECTION
    - USES IN PUNCHED CARD INSTALLATION
    - LOW PRIMARY
    - LOW SECONDARY
    - POCKET 4
    - POCKET 1
2. MATCHING
    - USES IN PUNCHED CARD INSTALLATION
    - EQUAL
    - POCKET 3

PROJECT DIAGRAM AND TEST WIRING PROBLEMS 13-20
QUESTIONS 20-21, P 110, 077 TEXT

REFERENCE 077 TEXT, PP 89-94

* * *

FIRST YEAR AUGUST 4, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TO LEARN THE PRINCIPLES OF WIRING THE FOLLOWING OPERATIONS ON THE 077 COLLATOR

1. LAST CARD OF A GROUP
2. ALL BUT THE LAST CARD OF A GROUP
3. FIRST CARD OF A GROUP
4. ALL BUT THE FIRST CARD OF A GROUP
5. SINGLE CARD GROUPS
6. MULTIPLE CARD GROUPS
7. NEEDED MACHINE FEATURES
    - HIGH PRIMARY SEQUENCE
    - EQUAL PRIMARY SEQUENCE
    - CYCLE DELAY SELECTOR
    - DROP OUT HUBS

PROJECT DIAGRAM AND TEST WIRING PROBLEMS 21-26

REFERENCE 077 TEXT, PP 94-109

* * *

FIRST YEAR AUGUST 6, 1965 1230-230 MR. DUERSTOCK

OBJECTIVE TEST COVERING WIRING OF 077 COLLATOR

1. MULTIPLE CHOICE QUESTIONS
2. WIRING DIAGRAMS

PROJECT NONE

REFERENCE OPERATORS GUIDE PP 45-49
077 TEXT, PP 73-110

* * *

FIRST YEAR AUGUST 9, 1965 830-1000 MRS. THORPE

OBJECTIVE TO LEARN THE EXTERNAL FEATURES OF THE 407 ACCOUNTING MACHINE

1. MACHINE FEATURES
    - CONTROL PANEL
    - KEYS AND LIGHTS
    - SWITCHES
    - PRINT UNIT
    - COUNTERS
2. MACHINE FUNCTIONS
    - DETAIL PRINTING
    - GROUP PRINTING
    - ACCOUNTING
    - PROGRAM STEPS
    - SUMMARY PUNCHING
3. TAPE-CONTROLLED CARRIAGE
    - A SEPARATE MACHINE
    - FORMS TRACTOR
    - CARRIAGE TAPE
    - PLATEN CLUTCH, KNOB
    - CONTINUOUS FORM PAPER

PROJECT EQUIPMENT FAMILIARIZATION DURING LABORATORY PERIOD

REFERENCE OPERATORS GUIDE, PP 90-100

* * *

FIRST YEAR AUGUST 9, 1965 830-1000 MR. DUERSTOCK

OBJECTIVE TO LEARN THE PRINCIPLES OF WIRING THE FOLLOWING OPERATIONS ON THE 407

1. DETAIL PRINTING
    - AVAILABLE PRINT ENTRIES

```
                          ZERO PRINT CONTROL
                          SPACE WIRING
                          CARRIAGE OVERFLOW
                2.   ADDITION
                          COUNTER ENTRY
                          COUNTER EXIT
                          COUNTER CONTROLLED PRINT
                          COUNTER CONTROL
                          CARD CYCLES
                          FINAL TOTAL HUBS

PROJECT         DIAGRAM AND WIRE PROBLEMS 1-4 (SPECIAL HANDOUT)

REFERENCE       REFERENCE MANUAL, IBM 407 ACCOUNTING MACHINE A24-10114
                PP 1-15, 46-49, 117-120

*******************************************************************************

FIRST YEAR                      AUGUST 11, 1965     1230-230  MR. DUERSTOCK

OBJECTIVE       TEST COVERING 407 WIRING SUBJECTS

                1.   DETAIL PRINTING
                2.   ADDITION
                3.   ZERO PRINT CONTROL

PROJECT         NONE

REFERENCE       407 REFERENCE MANUAL, PP 1-15, 46-49, 117-120
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FIRST YEAR JUNE 21, 1965 230-430 MR. OWEN

OBJECTIVE TO BECOME FAMILIAR WITH THE FUNCTION OF THE BASIC COMPUTER SYSTEM AND TO OBSERVE A PROGRAM IN OPERATION

1. CENTRAL PROCESSING UNIT
2. CARD READ-PUNCH
3. PAPER TAPE READ-PUNCH
4. TYPEWRITER
5. DISK STORAGE
6. RUNNING AND AMORTIZATION SCHEDULE

PROJECT EACH STUDENT RUNS AN AMORTIZATION SCHEDULE

REFERENCE IBM 1620 CENTRAL PROCESSING UNIT, MODEL 2, NO A26-5706, PAGE II, 2

****

FIRST YEAR JUNE 22, 1965 230-430 MR. OWEN

OBJECTIVE TO STUDY THE ORGANIZATION OF STORAGE IN THE IBM 1620 AND THE METHOD OF REPRESENTING NUMBER

1. THE STORAGE CELL CONCEPT
2. ADDRESSING SYSTEMS
3. MODULE SIZE IN THE 1620
4. WRAP-AROUND STORAGE
5. REPRESENTING A DIGIT IN STORAGE
    - 1-2-4-8 BITS
    - CHECK BITS
    - FLAG BITS

PROJECT COMPLETE RUNNING OF THE AMORTIZATION SCHEDULE.

REFERENCE IBM 1620 CENTRAL PROCESSING UNIT, MOD 1 NO. A 26-5706-1 PAGE 3-6

****

FIRST YEAR JUNE 23, 1965 230-430 MR. OWEN

OBJECTIVE TO DEMONSTRATE THE CHARACTER AND FUNCTION OF THE 1620 INSTRUCTION AND METHODS OF ENTERING INSTRUCTION INTO THE COMPUTER.

1. PROGRAM - TO REPRODUCE A DECK OF CARDS IN THE NUMERIC MODE.
2. THE PROGRAM
   ADDRESS OP CODE P-ADDRESS Q-ADDRESS

00000	36	01000	00500
00012	38	01000	00400
00024	49	00000	00000

PROJECT KEY PUNCH AND RUN THE ABOVE PROGRAM LOADING IT BY USING THE 1622 LOAD BUTTON.

REFERENCE 1620 CPU PAGES 7, 30, 39, AND 41

****

FIRST YEAR JUNE 24, 1965 230-430 MR. OWEN

OBJECTIVE TO CONTINUE THE STUDY OF THE 1620 INSTRUCTION INTRODUCED IN THE PREVIOUS LECTURE AND TO CONSIDER ANY PROBLEM THAT DEVELOPED IN THE LABORATORY

PROJECT COMPLETE THE PROJECT ASSIGNED JUNE 23

REFERENCE 1620 CPU PAGES 7, 30, 39, AND 41

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FIRST YEAR JUNE 25, 1965 230-430 MR. OWEN

OBJECTIVE TO STUDY ALPHAMERIC INPUT-OUTPUT INSTRUCTION AND NOTE THE SIMILARITIES AND DIFFERENCES TO THE NUMERIC INSTRUCTION

1. PROGRAM - TO REPRODUCE A DECK OF CARDS
2. THE PROGRAM

ADDRESS	OP CODE	P-ADDRESS	Q-ADDRESS
00000	37	01001	00500
00012	39	01001	00400
00024	49	00000	00000

3. REPEAT THE ABOVE EXCEPT FOR THE LAST INSTRUCTION WHICH SHOULD BE A BRANCH OR 33312 INSTEAD OF TO 00000.

PROJECT KEY PUNCH AND RUN THE ABOVE PROGRAM LOADING IT BY USING THE 1622 LOAD BUTTON. RE-ENTER THE SAME PROGRAM USING THE TYPEWRITER.

REFERENCE 1620 CPU PAGES 7, 30, 41, 52-54, AND 56

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FIRST YEAR JUNE 28, 1965 230-430 MR. OWEN

OBJECTIVE TO REVIEW THE I/O INSTRUCTIONS AND TO STUDY THE UNCONDITIONAL BRANCH INSTRUCTION AND THE FUNCTION OF THE INSERT KEY

1. PROGRAM - TO READ A CARD AND MAKE MANY COPIES OF THAT ONE CARD
2. RESTART THE PROGRAM USING
   SIE - RESET - INSERT - START
3. THE PROGRAM

```
ADDRESS  OP CODE   P-ADDRESS  Q-ADDRESS
 00000     37        01001      00500
 00012     39        01001      00400
 00024     49        00012      00000
```

PROJECT KEY PUNCH AND RUN THE ABOVE PROGRAM PRODUCING 3 OR 4 COPIES OF EACH OF A DECK OF CARDS

REFERENCE 1620 CPU, PAGES 30, 39-42

* * *

FIRST YEAR JUNE 29, 1965 230-430 MR. OWEN

OBJECTIVE TO PROGRAM AND OBSERVE THE OPERATION OF THE INPUT-OUTPUT DEVICES (PAPER TAPE, TYPEWRITER, PRINTER, AND CARDS)

1. PROGRAMS - TO READ A CARD ALPHAMERICALLY AND
   TYPE THE CARD ON THE TYPEWRITER
   PUNCH THE CARD ON PAPER TAPE
   PRINT THE CARD ON THE PRINTER
2. THE PROGRAM

```
ADDRESS  OP CODE   P-ADDRESS  Q-ADDRESS
 00000     37        01001      00500
 00012     34        00000      00102
 00024     39        01001      00100
 00036     39        01001      00200
 00048     39        01001      00900
 00060     49        00000      00000
```

PROJECT KEY PUNCH AND RUN THE ABOVE PROGRAM. REPUNCH AND RUN THE SAME PROGRAM EXCEPT OUTPUT IN THE NUMERIC MODE. FOR THIS PROGRAM, WHY IS IT NECESSARY TO PUNCH A RECORD MARK IN THE DATA CARD

REFERENCE 1620 CPU, PAGES 39-42

* * *

FIRST YEAR JUNE 30, 1965 230-430 MR. OWEN

OBJECTIVE TO STUDY THE CONDITIONAL BRANCH INSTRUCTION

1. PROGRAM - TO REPRODUCE A DECK OF CARDS AND HALT AFTER THE LAST CARD TO BE REPRODUCED HAS BEEN PUNCHED
2. THE PROGRAM

```
ADDRESS  OP CODE   P-ADDRESS  Q-ADDRESS
 00000     37        01001      00500
 00012       39        01001       00400
 00024       47        00000       00900
 00036       48        00000       00000
 00048       49        00000       00000
```

PROJECT PUNCH AND RUN THE ABOVE PROGRAM
PLAN (FLOW CHART) A PROGRAM TO GANGPUNCH UNDER CONSOLE SWITCH CONTROL

REFERENCE 1620 CPU, PAGES 32-33

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FIRST YEAR JULY 1, 1965 230-430 MR. OWEN

OBJECTIVE TO STUDY CONDITIONAL BRANCHES

1. PROGRAM - TO PUNCH 4 CARDS OF EACH TYPE CONTAINED IN A DECK OF CARDS
2. THE PROGRAM (THE STUDENT SHOULD PLACE FLAGS WHERE REQUIRED)

```
ADDRESS  OP CODE   P-ADDRESS  Q-ADDRESS
 00000     16        00073      00004
 00012     37        01001      00500
 00024     39        01001      00400
 00036     11        00073      00001
 00048     47        00012      01200
 00060     49        00000      00000
 00072     04
```

3. PROGRAM - TO PUNCH A NUMBER OF CARDS OF EACH TYPE CONTAINED IN A DECK OF CARDS. USE A SWITCH TO STOP PUNCHING ONE CARD AND START THE NEXT ONE
4. THE PROGRAM

```
ADDRESS  OP CODE   P-ADDRESS  Q-ADDRESS
 00000     46        00000      00100
 00012     37        01001      00500
 00024     39        01001      00400
 00036     47        00024      00100
 00048     49        00000      00000
```

PROJECT PUNCH AND EXECUTE THE ABOVE PROGRAMS. WRITE A PROGRAM TO PRODUCE TWO CARDS OF EACH TYPE

REFERENCE 1620 CPU, PAGES 32-33

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FIRST YEAR JULY 2, 1965 230-430 MR. OWEN

OBJECTIVE TO STUDY METHODS OF LOADING PROGRAMS AT LOCATIONS OTHER THAN ZERO AND TO INTRODUCE ADDRESS MODIFICATION

1. LOAD A PROGRAM FROM TAPE USING A LOAD PROGRAM SUCH AS

```
36 00402 00300
49 00402
```

2. LOAD A PROGRAM FROM CARDS (ONE INSTRUCTION PER CARD) BY REPEATED READ INSTRUCTIONS FOLLOWED BY A BRANCH
3. LOAD A PROGRAM FROM CARDS (ONE INSTRUCTION PER CARD) BY ADDRESS MODIFICATION

PROJECT WRITE A PROGRAM TO REPRODUCE A DECK OF CARDS AND LOAD IT BY EACH OF THE METHODS DESCRIBED ABOVE

REFERENCE 1620 CPU, PAGE 86

* * *

FIRST YEAR JULY 6, 1965 230-430 MR. OWEN

OBJECTIVE TO REVIEW BASIC MACHINE LANGUAGE PROGRAMMING AND TO UTILIZE AN ARITHMETIC COMMAND

1. THE PROBLEM - A FOUR-DIGIT NUMBER IN CARD COLUMN 1 THROUGH 4 AND ANOTHER IN CARD COLUMN 5 THROUGH 8 ARE TO BE ADDED. PUNCH A DUPLICATE OF THE ORIGINAL CARD EXCEPT WITH THE SUM IN CARD COLUMN 9 THROUGH 13.
2. NOTE THAT COMPLETE DUPLICATION OF THE CARD MAY NOT BE POSSIBLE.
    - BLANK COLUMN
    - ALPHA DATA
3. THE PROGRAM

```
STORAGE        OP-CODE     P-ADDRESS     Q-ADDRESS

00402            36          01001         00500
00414            32          01001         00000
00426            32          01005         00000
00438            16          01013         -0000
00450            21          01013         01004
00462            21          01013         01008
00474            33          01001         00000
00486            33          01005         00000
00498            33          01009         00000
00510            38          01001         00000
00522            49          00402
```

PROJECT KEYPUNCH THE ABOVE PROGRAM INTO CARDS, LOAD AND EXECUTE TRY VARIATIONS SUCH AS MAKING THE NUMBER TO BE ADDED NEGATIVE.

REFERENCE IBM 1620 CPU, PAGES 12-15

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FIRST YEAR JULY 7, 1965 230-430 MR. OWEN

OBJECTIVE TO STUDY THE SYMBOLIC PROGRAMMING SYSTEM AND THE GENERAL PROCEDURE USED BY THE SYSTEM FOR THE CONVERSION FROM SPS TO MACHINE LANGUAGE.

1. THE PROBLEM - TO REPRODUCE FOUR OF A KIND FROM EACH CARD OF CARD OF A DECK.

2. THE PROGRAM (IN SPS)

```
START          TFM       COUNT, 4, 10
               RACD      CARD
WRITE          WACD      CARD
               SM        COUNT
               BNZ       WRITE
               B         START
COUNT          DS        2
CARD           DAS       80
               DEND     START
```

PROJECT PUNCH, COMPILE (WITH LIST), AND EXECUTE THE ABOVE CHANGES. CHECK CHANGES. CHECK THE ACCURACY OF THE MACHINE LANGUAGE EQUIVALENT ON THE LIST.

REFERENCE IBM 1620 MONITOR I, C26-5739-2, PAGES 14-15, 46-56, 88-89

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FIRST YEAR JULY 8, 1965 230-430 MR. OWEN

OBJECTIVE TO LEARN TO COMPILE AND EXECUTE AN SPS PROGRAM USING 1620 MONITOR AND ITS OPTIONS.

1. FUNCTION OF THE COLD START CARD
2. MONITOR CONTROL CARDS
    - SPSX
        - PRINT SYMBOL TABLE
        - LIST PRINTER
        - STORE CORE IMAGE
        - STORE RELOADABLE
        - PUNCH RESEQUNCE SOURCE DECK
    - XEQ NAME
    - DISK UTILITY PROGRAM
        - DDUMP (DUMP EQUIVALENCE TABLE)
        - DELET (DELETE)
    - ERROR LIST

PROJECT ASSEMBLE THE SPS PROGRAM WRITTEN ON THE JULY 7 PROJECT

1. LIST ON THE PRINTER
2. PUNCH RESEQUENCE SOURCE DECK
3. STORE CORE IMAGE
4. DUMP EQUIVALENCE TABLE AND OBSERVE NAME
5. EXECUTE THE PROGRAM

6. DELETE THE PROGRAM FROM DISKS
7. DUMP EQUIVALENCE TABLE AND NOTE NAME DELETED

REFERENCE 1620 MONITOR, PAGES 8, 14-16, 35, 87, 155-156

* * *

FIRST YEAR JULY 9, 1965 230-430 MR. OWEN

OBJECTIVE TO STUDY A SIMPLE BUT PRACTICAL PROBLEM THAT CAN BE WRITTEN IN SPS

1. THE PROBLEM - TO WRITE A PROGRAM WHICH WILL COMPUTE THE AMOUNT OF PAY (NET) AND PUNCH A YEAR-TO-DATE SUMMARY
2. SPECIFY THE DATA AND ITS LOCATION OF A CARD FOR BOTH INPUT AND OUTPUT
3. BEGIN THE FLOW CHARTING OF THE PROBLEM

PROJECT COMPLETE FLOW CHARTING OF THE PAYROLL PROBLEM

REFERENCE IBM 1620 MONITOR F, PAGES 46-49, 62-65, 87-94

* * *

FIRST YEAR JULY 12, 1965 230-430 MR. OWEN

OBJECTIVE TO CONTINUE THE PAYROLL PROBLEM STARTED JULY 9, 1965

1. REVIEW THE FLOWCHARTS PREPARED BY THE STUDENTS
2. WRITE THE PROBLEM IN SPS

PROJECT EACH STUDENT SHOULD WRITE THE PROGRAM IN SPS ACCORDING TO THEIR VERSION OF THE FLOWCHART. PUNCH AND EXECUTE THE PROGRAM

REFERENCE IBM 1620 MONITOR I, PAGES 46-59, 62-65, 87-94

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FIRST YEAR JULY 28, 1965 1230-430 MR. DUERSTOCK

OBJECTIVE TO INTRODUCE THE CONCEPTS OF THE IBM/360

1. GENERAL INFORMATION
2. PROCESSING UNIT
3. CORE STORAGE
4. BINARY VS BCD COMPUTERS
    - WORDS-STORAGE POSITIONS
    - FIXED-VARIABLE LENGTH
    - REGISTER-STORAGE OPERATIONS
    - INSTRUCTION ACCESS TIME
    - SEQUENTIAL-PARALLEL ARITHMETIC
5. STORAGE ADDRESSING PRINCIPLE
    - CONTROL SECTION
    - BASE VALUE
    - DISPLACEMENT
    - INDEX
6. INSTRUCTION SETS
    - STANDARD
    - DECIMAL
    - FLOATING POINT BINARY
    - STORAGE PROTECTION
    - UNIVERSAL
7. DATA REPRESENTATION
    - BINARY
    - PACKED DECIMAL
    - ZONED DECIMAL
8. INSTRUCTION FORMATS
    - RR REGISTER TO REGISTER
    - RI REGISTER TO INDEXED STORAGE
    - RS REGISTER TO STORAGE
    - SI STORAGE AND IMMEDIATE
    - SS STORAGE TO STORAGE

PROJECT NONE

REFERENCE IBM SYSTEM/360 INTRODUCTORY NOTES, C20-1608-1, PP 1-11

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FIRST YEAR JULY 29, 1965 1230-430 MR. DUERSTOCK

OBJECTIVE TO CONTINUE THE STUDY OF SYSTEM/360 CONCEPTS

1. INPUT/OUTPUT EQUIPMENT MODULARITY
2. CHANNELS
    - SELECTOR CHANNEL
    - MULTIPLEXOR CHANNEL
3. CHANNEL OPERATION
4. SYSTEM/360 PROCESSOR FEATURES

- AUTOMATIC INTERRUPT
- STORAGE PROTECTION FEATURE
- PROTECTED SUPERVISOR PROGRAM
- SUPERVISOR-CONTROLLED
  - PROGRAM SWITCHING
  - INPUT/OUTPUT
- NONSTOP OPERATION
- EASY PROGRAM RELOCATION
- INTERVAL TIMER
- EXTENSIVE DATA CHECKING
- SYSTEM CONTROL PANEL (CONSOL)

5. MULTIPROCESSING
6. MULTIPROGRAMMING

PROJECT NONE

REFERENCE IBM/360 NOTES, PP 12-19

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FIRST YEAR JULY 30, 1965 1230-430 MR. DUERSTOCK

OBJECTIVE TO CONTINUE THE STUDY OF SYSTEM/360 CONCEPTS

1. STORAGE ORGANIZATION
   - BYTE
   - HALFWORD
   - FULLWORD
   - DOUBLEWORD
2. INSTRUCTION FORMAT
   - VARIABLE LENGTH
   - ACTUAL INSTRUCTION LENGTHS
3. CHANNELS
   - USES
   - TYPES
   - MODES OF OPERATION
4. FILM--SYSTEM/360 OPERATING SYSTEM

PROJECT NONE

REFERENCE IBM/360 NOTES, PP 12-19

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SECOND YEAR JUNE 21, 1965 1230-230 MR. OWEN

OBJECTIVE TO REVIEW THE BASIC ORGANIZATION OF IBM 1620 CORE STORAGE AND INSTRUCTION FORMAT.

1. TABLE AREA (MULTIPLY AND DIVIDE)
2. PRODUCT AND QUOTATION AREA
3. INSERT AND LOAD AREA
    FUNCTION OF INSERT AND LOAD KEY
4. MONITOR AREA
5. PROGRAM AREA
6. TWO DIGIT CORE READ OUT CHARACTERS AND COMPARISON WITH OTHER MACHINES
7. INSTRUCTION - OPCODE, P AND Q

PROJECT NONE

REFERENCE 1620 MONITOR I SYSTEMS REFERENCE MANUAL, C26-5739-2
1620 CPU

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SECOND YEAR JUNE 23, 1965 1230-230 MR. OWEN

OBJECTIVE TO REVIEW SPS AND THE RESULTING MACHINE LANGUAGE TESTING USING A SIMPLE GANGPUNCHING PROGRAM

1. PROGRAM - TO REPRODUCE FOUR CARDS OF EACH TYPE FROM A DECK OF CARDS
2. THE PROGRAM

```
LABEL        OP CODE              OPERANDS
START          TFM                COUNT, 4
               RN                 CARD
WRITE          WN                 CARD
               SM                 COUNT, 1
               BP                 WRITE
               B                  START
COUNT          DS                   5
CARD           DAS                 80
               DEND               START
```

PROJECT KEYPUNCH AND RUN THE ABOVE PROGRAM OBTAINING A BIT

REFERENCE IBM 1620 MONITOR I SYSTEM REFERENCE MANUAL C 26-5739-2
PAGE 15, 46-56

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SECOND YEAR JUNE 25, 1965 1230-230 MR. OWEN

OBJECT TO CONTINUE THE REVIEW OF SPS AND TO DEMONSTRATE METHOD OF TERMINATING LOOPS

1. PROGRAM - TO ADD 16 FIVE-DIGIT NUMBER ARRANGED ACROSS A CARD
2. THE PROGRAM

```
LABEL       OP CODE            OPERANDS
START       TFM                TOTAL, ZERO
            TFM                COUNT, 4, 10
            TFM                FLAD + 6, INPUT + 1
            TFM                ADD + 11, INPUT + 5
            RNCD               INPUT + 1
FLAG        SF                 INPUT + 1, 2
            AM                 FLAG + 6, 5
            BNF                FLAG, INPUT + 76
ADD         A                  TOTAL, INPUT + 5
            AM                 ADD + 11, 5
            BNR                ADD, ADD + 11, 11
            RCTY
            WNTY               TOTAL - 6
            B                  START
TOTAL       DS                 7
            DC                 1, - @
ZERO        DC                 7, 0
COUNT       DS                 2
            DEND               START
```

PROJECT KEY PUNCH THE PROGRAM TO ADD 16 NUMBERS AND OBSERVE THE THE MACHINE LANGUAGE PROGRAM GENERATED

REFERENCE 1620 MONITOR, PAGES 46-56

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SECOND YEAR JUNE 29, 1965 1230-230 MR. OWEN

OBJECTIVE TO REVIEW FORTRAN

1. WRITE A PROGRAM TO OBTAIN THE SUM OF 16 FIVE-DIGIT NUMBERS ARRANGED ACROSS A CARD
2. THE PROGRAM

```
   DIMENSION
10 ISUM = 0
   READ 20, (N (I), I = 1, 16)
20 FORMAT (16I5)
   DO 30 I = 1, 16
30 ISUM = ISUM + N (I)
   TYPE 40, ISUM
   FORMAT (I7)
   GO TO 10
   END
```

PROJECT WRITE AND EXECUTE A PROGRAM SIMILAR TO THE ABOVE EXCEPT

CHANGE THE FORMAT OF THE NUMBER ACROSS THE CARD TO 20
FOUR-DIGIT NUMBERS.

REFERENCE 1620 MONITOR I, PAGES 95-124

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SECOND YEAR JUNE 30, 1965 1230-230 MR. OWEN

OBJECTIVE TO STUDY THE UTILITY PROGRAM AVAILABLE UNDER 1620 MONITOR

1. PROGRAM STORAGE
2. DELETE PROGRAM
3. DEFINE PARAMETERS
4. DEFINE DISK PACK LABEL
5. DISK-TO-OUTPUT

PROJECT COMPILE THE FORTRAN PROGRAMS WRITTEN IN CLASS ON JUNE 29, 1965 AND LOAD TO DISK. EXECUTE THE PROGRAM FROM A COLD START AND THEN DELETE. CHECK THE EQUIVALENCE TABLE BEFORE AND AFTER DELETION.

REFERENCE 1620 MONITOR I, PAGES 31-45

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SECOND YEAR JULY 2, 1965 1230-230 MR. OWEN

OBJECTIVE TO STUDY MORE STORAGE DEVICES SUCH AS MAGNETIC TAPE AND DISK

1. IBM 1311 AS AN EXAMPLE OF DISK STORAGE SYSTEM
    - ADDRESSING SYSTEMS
    - INSTRUCTION
    - DISK CONTROL FIELD
2. NATURE OF THE MAGNETIC RECORDING OF DATA
3. MAGNETIC TAPE CHARACTERISTICS
    - DENSITY
    - BLOCKING FACTOR
    - CARE OF TAPE

PROJECT WRITE A PROGRAM TO READ A SECTOR OF DATA FROM DISK AND PRESENT THE DATA ON THE PRINTER

REFERENCE 1620 CPU, PAGES 43-51

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SECOND YEAR JULY 7, 1965 1230-230 MR. OWEN

OBJECTIVE TO CONTINUE THE STUDY OF THE 1311 DISK FILES

1. USE REQUIREMENTS
    - DISK FILE NUMBER
    - SECTOR ADDRESS
    - NUMBER OF SECTORS
    - PLACE IN CORE
2. OVERRIDE CODE
3. SETTING THE ARM
4. DISK TO PRINTER ROUTINE

PROJECT WRITE A PROGRAM TO PRINT EVERY DISK SECTOR STARTING FROM 00000

REFERENCE IBM 1311 DISK STORAGE DRIVE, MODEL 3, A26-5650, PP 1-20

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SECOND YEAR JULY 9, 1965 1230-230 MR. OWEN

OBJECTIVE TO STUDY TWO ASPECTS OF THE SOFTWARE PACKAGE

1. INPUT/OUTPUT ROUTINES
    - OPENING AND CLOSING FILES
    - TRANSFERRING RECORDS
    - BLOCKING AND DEBLOCKING RECORDS
    - CHECKING AND WRITING DISK OR TAPE LABEL
    - ERROR CHECKING
2. SORT-MERGE ROUTINES
    - DEVICES NEEDED
    - SORT TECHNIQUES
    - MERGE TECHNIQUES

PROJECT NONE

REFERENCE IBM BASIC OPERATING SYSTEM/360, C24-3361, P 52-112

* * *

SECOND YEAR JULY 12, 1965 1230-230 MR. OWEN

OBJECTIVE TO DISCUSS THE FORTRAN FORMAT STATEMENT

1. FANDK LIMITS
    - FLOATING POINT-2 TO 28
    - FIXED POINT-4 TO 10
2. PERMITTED LETTERS IN VARIABLES
    - I
    - F
    - H
    - A
3. EXAMPLES OF FORMAT STATEMENT

PROJECT WRITE AN SPS AND A FORTRAN PROGRAM TO DUPLICATE A DECK OF CARDS

REFERENCE 1620 MONITOR I, PP 111-114

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SECOND YEAR JULY 14, 1965 1230-230 MR. OWEN

OBJECTIVE TO STUDY THE IBM SYSTEM/360

1. GENERAL INFORMATION
    - PHILOSOPHY OF SYSTEM
    - COMPATIBILITY
2. PROCESSING UNIT
    - MODULARITY
3. BINARY VS BCD COMPUTERS
    - WORDS-STORAGE POSITIONS
    - FIXED-VARIABLE LENGTH
    - REGISTER-STORAGE OPERATIONS
    - INSTRUCTION ACCESS TIME
    - SEQUENTIAL-PARALLEL ARITHMETIC
4. CHANNELS
5. SYSTEM/360 PROCESSOR FEATURES

PROJECT NONE

REFERENCE IBM SYSTEM/360 INTRODUCORY NOTES, C20-1608, PP 1-13

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SECOND YEAR JULY 16, 1965 1230-230 MR. OWEN

OBJECTIVE TO STUDY THE CORE OF SYSTEM/360 AND TO SEE ITS IMPLICATIONS

1. STORAGE ADDRESSING PRINCIPLE
    - CONTROL SECTION
    - BASE VALUE
    - DISPLACEMENT
    - INDEX
2. DATA REPRESENTATION
    - BINARY
    - PACKED DECIMAL
    - ZONED DECIMAL
3. SECTIONING OF PROGRAM
    - 1000 INSTRUCTIONS
    - 4096 BYTES
    - 40 CODING SHEETS

PROJECT NONE

REFERENCE IBM/360 NOTES, PP 5-11

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SECOND YEAR JULY 19, 1965 1230-230 MR. OWEN

OBJECTIVE TO CONTINUE THE STUDY OF SYSTEM/360

1. NUMBERING SYSTEMS
    - DECIMAL
    - OCTAL
    - BINARY
    - HEXADECIMAL
2. NUMBER REPRESENTATION
    - FIXED
    - PACKED DECIMAL
    - ZONED DECIMAL
    - FLOATING POINT

PROJECT NONE

REFERENCE IBM/360 NOTES, PP 9-11

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SECOND YEAR JULY 21, 1965 1230-230 MR. OWEN

OBJECTIVE TO STUDY THE IBM/360 BASIC ASSEMBLY LANGUAGE

1. GENERAL INFORMATION
    - ASSEMBLER LANGUAGE CODING CONVENTIONS
    - ASSEMBLER LANGUAGE STRUCTURE
    - TERMS
    - EXPRESSIONS
2. ADDRESSING
    - PROGRAM SECTIONING
    - PROGRAM LINKING
3. MACHINE INSTRUCTIONS
    - STATEMENTS
    - MNEMONIC CODES
    - EXTENDED MNEMONIC CODES

PROJECT NONE

REFERENCE IBM BASIC OPERATING SYSTEM/360 ASSEMBLER, C24-3361, PP 1-32

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SECOND YEAR JULY 23, 1965 1230-230 MR. OWEN

OBJECTIVE TO STUDY THE BASIC OPERATING SYSTEM OF THE 360

1. AUTOMATIC INTERRUPT
2. STORAGE PROTECTION FEATURE
3. PROTECTED SUPERVISOR PROGRAM

4. SUPERVISOR-CONTROLLED
   PROGRAM SWITCHING
   INPUT/OUTPUT
5. NONSTOP OPERATION
6. EASY PROGRAM RELOCATION
7. INTERVAL TIMER
8. EXTENSIVE DATA CHECKING
9. MULTIPROCESSING
10. MULTIPROGRAMMING

PROJECT NONE

REFERENCE IBM/360 NOTES, PP 12-19

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SECOND YEAR JULY 26, 1965 1230-230 MR. OWEN

OBJECTIVE TO STUDY THE IBM 1401 PROGRAMMING LANGUAGE

1. SYMBOLIC LANGUAGE
2. PROCESSOR PROGRAM
3. INFORMATION REQUIREMENTS
4. CODING SHEET
5. IMPERATIVE OPERATIONS
6. DECLARATIVE OPERATIONS
7. PROCESSOR CONTROL OPERATIONS
8. SPS PROCESSOR OPERATIONS
9. SAMPLE PROGRAM

PROJECT NONE

REFERENCE IBM 1401 SYMBOLIC PROGRAMMING SYSTEMS SPS-1 AND SPS-2,
C24-1480, PP 7-21

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SECOND YEAR JULY 27, 1965 1230-230 MR. OWEN

OBJECTIVE TO STUDY THE VARIOUS ASPECTS OF TAPE PROCESSING AND SORTING

1. MAGNET TAPE RECORD
   UNBLOCKED
   BLOCKED
   TAPE MARK
   INTER-RECORD GAP
   DATA REPRESENTATION
   DENSITY
   7-BIT CODING
2. SORTING
   METHODS
   TAPE UNITS REQUIRED
   CONTRAST TAPE WITH CARD SORTING

TAG SORT

PROJECT NONE

REFERENCE IBM 1401 DATA PROCESSING SYSTEM, A24-1403, PP 55-62

FIRST AND SECOND YEAR JUNE 22, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY THE SYSTEM STAFF AND ITS RELATIONSHIP TO MANAGEMENT.

1. MANAGEMENT
    DEFINITION
    FUNCTIONS
2. SYSTEMS
    EVOLUTION OF SYSTEMS
    SYSTEMS DEPARTMENT
    TYPES OF SYSTEMS STAFFS
3. ORGANIZATION SYSTEMS ANALYSIS
    ELEMENTS OF ORGANIZATION
4. ORGANIZATION DESIGN

PROJECT PREPARE ORGANIZATION CHART

REFERENCE BUSINESS SYSTEMS, CHAPTERS 1 AND 2

OBJECTIVE TO EXPLAIN SYSTEMS FUNCTIONS, CONCEPTS AND PROGRAMS

1. NEED FOR SYSTEMS STAFF
2. SYSTEMS FUNCTIONS
    ORGANIZATION PLANNING AND ANALYSIS
    SYSTEMS ANALYSIS AND DESIGN
    MANAGEMENT AUDIT
    POLICIES, PROCEDURES, AND BULLETINS
    FORMS DESIGN AND CONTROL
    REPORTS ANALYSIS AND CONTROL
    RECORDS MANAGEMENT
    WORK MEASUREMENT
    OFFICE EQUIPMENT SELECTION
    OFFICE LAYOUT
    SYSTEMS IMPLEMENTATION
3. SYSTEMS CONCEPTS
    TYPES OF APPROACHES
    GAINS FROM EDP
    TOTAL SYSTEMS
4. SYSTEMS PROGRAMS
    OBJECTIVES AND POLICIES
    OBSTACLES

PROJECT NONE

REFERENCE BUSINESS SYSTEMS, CHAPTER 3

FIRST AND SECOND YEAR JUNE 24, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY THE PROCEDURES FOR MAKING A SYSTEM SURVEY

1. REASON FOR A BUSINESS SYSTEM
2. SURVEY INITIATION
3. PLANNING THE STUDY
4. BEGINNING THE STUDY
5. FACT GATHERING
6. RECORDING DATA
7. CONDUCTING THE STUDY
    - DATA TO BE GATHERED
    - DUTIES OF PERSONNEL
    - POLICIES
    - DETAILS OF EXISTING SYSTEMS
    - ANALYSIS
8. HUMAN RELATIONS

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOL. I, CHAPTER 4

OBJECTIVE TO STUDY VARIOUS MEANS OF PREPARING CHARTS FOR GRAPHIC PRESENTATION

1. CHARTING SYMBOLS
2. CHARTS AND THEIR USES
    - FLOW PROCESS CHART
    - HORIZONTAL FLOWCHART
    - VERTICAL FLOWCHART
    - COMBINATION VERTICAL AND HORIZONTAL CHART
    - SCHEMATIC FLOWCHART
    - MECHANIZED DATA PROCESSING CHARTS
    - FORM CHARTS
    - MAN AND MACHINE CHARTS
    - SCHEDULING AND PROGRESS CHART
    - WORK DISTRIBUTION CHART
    - ORGANIZATION CHART

PROJECT FLOWCHART PREPARATION

REFERENCE BUSINESS SYSTEMS VOL. I, CHAPTER 5

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FIRST AND SECOND YEAR JUNE 28, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY OFFICE LAYOUT AND ITS RELATIONSHIP TO SYSTEMS ANALYSIS

1. LAYOUT FACTS
2. LAYOUT ANALYSIS
3. SPACE REQUIREMENTS
4. OFFICE STANDARDS PROGRAM

5. OFFICE ENVIRONMENT

PROJECT OFFICE LAYOUT - MAIL DELIVERY FLOW

REFERENCE BUSINESS SYSTEMS, CHAPTER 6

OBJECTIVE TO GET AN OVERALL VIEW OF SYSTEMS ANALYSIS

1. ATTITUDE
2. APPROACH
3. MECHANICS
4. ORGANIZATION OF DATA
5. CHECK LIST

PROJECT NONE

REFERENCE BUSINESS SYSTEMS, CHAPTER 7

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FIRST AND SECOND YEAR JULY 1, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TEST COVERING CHAPTERS 1 THRU 7

OBJECTIVE TO POINT OUT THE NEED FOR SALESMANSHIP IN SYSTEMS WORK

1. SELLING YOUR IDEA
2. PRESENTATION OF PROPOSALS
   BE SURE OF YOURSELF
   TALK TO PEOPLE WHO CAN SAY YES
   MAKE CHANGES WHERE NECESSARY
   OBTAINING ASSISTANCE
   PLANNING THE PRESENTATION

PROJECT NONE

REFERENCE BUSINESS SYSTEMS, VOL. I, CHAPTER 8

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FIRST AND SECOND YEAR JULY 6, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY THE INSTALLATION AND FOLLOW-UP OF SYSTEMS.

1. STEP BY STEP INSTALLATION PLAN
2. TYPE OF INSTALLATION
3. INSTALLATION CONTROLS
4. TIME SCHEDULE
5. PERSONNEL
6. FORMS
7. MANUALS
8. PUBLICATION
9. TRAINING

10. FOLLOW-UP
11. SYSTEMS RESPONSIBILITY

PROJECT NONE

REFERENCE BUSINESS SYSTEMS, CHAPTER 9

FIRST AND SECOND YEAR JULY 8, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY FORMS ANALYSIS

1. USE OF FORMS
2. DATA NEEDS
3. PHYSICAL REQUIREMENTS
4. FORM LAYOUT
5. DISTRIBUTION OF FORM
6. MAILING REQUIREMENTS
7. FILING REFERENCE

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOLUME I, CHAPTER 11

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FIRST AND SECOND YEAR JULY 13, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY FORMS ANALYSIS

1. OBJECTIVES
2. SPECIFICATIONS
3. PAPER

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOLUME I, CHAPTER 11

OBJECTIVE TO STUDY ADMINISTRATIVE WORK MEASUREMENT AND ITS RELATION TO SYSTEMS ANALYSIS

1. DEFINITION OF WORK MEASUREMENT
2. MAIN VALUE OF WORK MEASUREMENT
3. OBJECTIVES OF WORK MEASUREMENT
4. WORK STANDARDS
5. PURPOSES OF WORK MEASUREMENT
6. PLANNING THE PROGRAM
7. SELECTING WORK TO BE STUDIED
8. METHODS OF MEASUREMENT

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOLUME I, CHAPTER 12

A GUIDE TO OFFICE CLERICAL TIME STUDIES
SYSTEMS AND PROCEDURES ASSOCIATION

OBJECTIVE DISCUSSION OF REGISTRATION PROCEDURES AND HOW A STUDY SHOULD BE MADE OF REGISTRATION TO ESTABLISH AN AUTOMATED SYSTEM

1. ADMISSIONS
2. REGISTRATION DAY

PROJECT NONE

REFERENCE REGISTRATION PROCEDURES AT MIAMI-DADE JUNIOR COLLEGE

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FIRST AND SECOND YEAR JULY 15, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY FORMS ADMINISTRATION PROGRAMS

1. SCOPE
2. DESIGN
3. REPRODUCTION AND PROCUREMENT
4. INVENTORY
5. CONTROL
6. FORMS FILES
7. FILE USES

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOLUME II CHAPTER 13

OBJECTIVE TO STUDY RECORDS MANAGEMENT PROGRAMS

1. FUNCTION
2. RECORDS RETENTION
    - TIME RETAINED
    - METHODS OF RETENTION
    - INVENTORY

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOLUME II CHAPTER 14

OBJECTIVE TO DISCUSS METHODS EMPLOYED BY MD-JC IN AUTOMATING THE LIBRARY CIRCULATION SYSTEM

1. LOCATION LIST
2. OVERDUE BOOKS
3. UNPAID FINES
4. STATISTICAL REPORT
5. INVENTORY

PROJECT NONE

REFERENCE SYSTEMS STUDY AND PRESENTATION OF MD-JC LIBRARY SYSTEM

OBJECTIVE DISCUSSION OF REGISTRATION PROCEDURES CONTINUED

1. DROP AND ADDS
2. GRADING PROCEDURES
3. GUIDANCE TEST BATTERY SCORING

PROJECT NONE

REFERENCE REGISTRATION PROCEDURES AT MD-JC

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FIRST AND SECOND YEAR JULY 20, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY THE VARIOUS TYPES OF OFFICE TOOLS THAT ARE AVAILABLE FOR SYSTEMS WORK

1. MAIN CATEGORIES
    - INFORMATION PREPARATION
    - INFORMATION COMMUNICATION
    - INFORMATION HANDLING AND STORAGE
2. INFORMATION PREPARATION
    - PEG BOARDS
    - ADDING MACHINE
    - CALCULATORS
    - TYPEWRITERS
3. INFORMATION COMMUNICATION
    - DUPLICATING MACHINES
    - COPYING MACHINES
    - DICTATING EQUIPMENT
    - INTERCOM EQUIPMENT
    - DATA TRANSMISSION
4. INFORMATION HANDLING AND STORAGE
    - PUNCHED CARDS
    - FORMS
    - MCBEE KEYSORT
    - COLLATING AND SORTING EQUIPMENT
    - FOLDING AND MAILING EQUIPMENT
    - FILING EQUIPMENT

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOL II CHAPTER 15

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FIRST AND SECOND YEAR JULY 22, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY THE PLACE OF KEYBOARD ACCOUNTING MACHINES IN SYSTEMS WORK

1. TYPES OF MACHINES
2. FUNCTIONS
    - RECORDING INFORMATION
    - WRITING AND COLLATING
    - CLASSIFYING AND SUMMARIZING
    - COMPUTING
    - CERTIFICATION AND PROTECTION
3. FORMS
4. SUCCESSFUL INSTALLATION AIDS

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOLUME II CHAPTER 16

OBJECTIVE TO STUDY THE PERIPHERAL DEVICES FOR PREPARATION OF MACHINE READABLE MEDIA

1. DEFINITION
2. TYPES OF MEDIA
    - PUNCH CARDS
    - PAPER TAPE
    - EDGE PUNCHED CARDS
3. EQUIPMENT
    - RECORDING DATA AT SOURCE
    - BY-PRODUCT PREPARATION
    - MACHINE LNGUAGE
    - CONVERTERS
    - MEDIA HANDLING

PROJECT NONE

REFERENCE BUSINESS VOLUME II CHAPTER 17

OBJECTIVE TO STUDY POSSIBLE APPLICATIONS FOR EDUCATIONAL INSTITUTIONS

1. BUSINESS DEPARTMENT
    - TAX BUDGET
    - DROP AND ADD PROCEDURE
2. ACADEMICLTEST SCORING
3. GUIDANCE TEST BATTERY SCORING
4. DUPLICATING DEPARTMENT

PROJECT NONE

REFERENCE MIAMI-DADE JUNIOR COLLEGE COMPUTER APPLICATIONS

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FIRST AND SECOND YEAR AUGUST 3, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY STEPS TO FOLLOW IN EDP FEASIBILITY STUDY PLAN

1. STEPS
   PREPARE STUDY PLAN
   ANALYZE PRESENT SYSTEM AND COSTS
   DEVELOP NEW GENERAL SYSTEM AND SPECIFICATIONS
   SELECT NEW EQUIPMENT
   SELECT NEW EQUIPMENT, SOFTWARE AND COSTS
   CALCULATE EXPECTED INSTALLATION COSTS
   COMPARE PRESENT AND NEW COSTS
   PRESENT RECOMMENDATIONS TO MANAGEMENT
2. SUMMARY

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOLUME II CHAPTER 20

OBJECTIVE TO STUDY MEANINGS AND EXAMPLES OF INTEGRATED INFORMATION SYSTEMS

1. DEFINITION
2. EXAMPLES

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOLUME II CHAPTER 21

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FIRST AND SECOND YEAR AUGUST 5, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY INFORMATION RETRIEVAL AS APPLIED TO HAND AND MECHANICAL SYSTEMS

1. DEFINITION
2. KEYWORDS--KWIC INDEX
3. COORDINATE INDEXING
4. HARDWARE
5. INFORMATION RETRIEVAL SYSTEM
6. STEPS OF THE SYSTEM
7. ABSTRACTING
8. INDEXING

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOL II CHAPTER 23, PRINCIPLES OF AUTOMATED INFORMATION RETRIEVAL

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FIRST AND SECOND YEAR AUGUST 10, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO STUDY A PAYROLL APPLICATION ON VARIOUS TYPES OF MECHANICAL EQUIPMENT

1. KEYBOARD ACCOUNTING MACHINES
2. ELECTRONIC ACCOUNTING MACHINES
3. MAGNETIC LEDGER CARD MACHINES
4. UNIT RECORD EQUIPMENT
5. EDP EQUIPMENT

PROJECT NONE

REFERENCE BROCHURES FROM NCR AND IBM

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FIRST AND SECOND YEAR AUGUST 12, 1965 1230-230 MR. FRIDLIN

OBJECTIVE TO REVIEW SYSTEMS PLANNING AND CONTROL

1. PLANNING
    - CORPORATE
    - SYSTEMS
2. FLEXIBILITY
3. MEASURING PROGRESS
4. REPORTING TO MANAGEMENT

PROJECT NONE

PREFERNCE BUSINESS SYSTEMS VOL II, CHAPTER 25

OBJECTIVE TO STUDY PERT (PROGRAM EVALUATION AND REVIEW TECHNIQUE)

1. DEFINITION
2. NETWORKS
3. ACTIVITY AND EVENT IDENTIFICATION
4. NETWORK MECHANICS
5. SCHEDULE EVALUATION
6. PROGRAM ANALYSIS

PROJECT NONE

REFERENCE BUSINESS SYSTEMS VOL II, APPENDIX B

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FIRST AND SECOND YEAR JULY 13, 1965 230-430 MR. OWEN

OBJECTIVE TO LEARN THE BASIC DIFFERENCE BETWEEN A COMPILER AND AN ASSEMBLER AND TO LEARN THE NUMBER SYSTEM USED BY FORTRAN II

1. ASSEMBLER - ONE FOR ONE
2. COMPILER
   - MANY FOR ONE
   - PROBLEM ORIENATED
3. CONSTANT
   - FIXED POINT - WHOLE NUMBER WITHOUT FRACTIONAL PART
   - FLOATING POINT - NUMBER WITH DECIMAL POINTS
4. VARIABLE
   - NAMES TO REPRESENT NUMBERS
   - MUST HAVE 1 TO 6 LETTERS OR NUMBER WITH THE FIRST CHARACTER A LETTER
   - FIXED POINT VARIABLE START I THROUGH N
   - FLOATING POINT START A THROUGH H OR LETTER O THROUGH Z

PROJECT NONE

REFERENCE IBM 1620 MONITOR I, PAGES 95-98

* * *

FIRST AND SECOND YEAR JULY 14, 1965 230-430 MR. OWEN

OBJECTIVE TO LEARN THE RUDIMENT OF FORTRAN PROGRAMMING BY WRITING A COMPLETE BUT SIMPLE PROBLEM.

1. THE PROBLEM - READ A CARD WITH A THREE-DIGIT NUMBER IN CC 1-3 AND ANOTHER IN CC 4-6. TYPE THE TWO NUMBERS AND THEIR SUM ON THE TYPEWRITER
2. THE PROGRAM

```
10 READ 20, NUM1, NUM2
20 FORMAT (213)
   ISUM = NUM1 + NUM2
   TYPE 30, NUM1, NUM2, ISUM
30 FORMAT (110,15,3X,14)
   GO TO 10
   END
```

PROJECT PUNCH, COMPILE, LIST AND EXECUTE THE ABOVE PROGRAM. TRY VARIATIONS SUCH AS SUBTRACTING ONE NUMBER FROM ANOTHER.

REFERENCE IBM 1620 MONITOR I, PAGES 65-98, 99, 101, 106-107, 111-113

* * *

FIRST AND SECOND YEAR JULY 15, 1965 230-430 MR. OWEN

OBJECTIVE TO WRITE A PROGRAM IN FORTRAN WHICH DEMONSTRATES CONTROL BY CONSOLE SWITCHES

1. THE PROBLEM - TO PRODUCE A NUMBER OF COPIES OF EACH CARD IN A DECK USING SWITCH 1 TO CONTROL THE CHANGE FROM ONE CARD TO THE NEXT
2. H-SPECIFICATION
3. WRITE THE PROGRAM USING THE H-SPECIFICATION FOR INPUT OUTPUT

PROJECT PUNCH THE ABOVE PROGRAM INTO CARDS AND EXECUTE

REFERENCE 1620 MONITOR I, PAGE 112

****

FIRST AND SECOND YEAR JULY 16, 1965 230-430 MR. OWEN

OBJECTIVE TO STUDY THE RULES CONTROLLING THE FORMATION OF FORTRAN ARITHMETIC STATEMENTS

1. ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION
2. USE OF PARENTHESES
3. PRIORITY OF OPERATIONS
4. MIXED MODE
5. ROUNDING OF FIXED AND FLOATING NUMBERS

PROJECT WRITE A PROGRAM TO ADD TWO NUMBERS READ FROM A CARD AND TYPE OUT THE TWO NUMBERS AND THEIR SUM

REFERENCE IBM 1620 MONITOR I, PAGES 99-101

****

FIRST AND SECOND YEAR JULY 19, 1965 230-430 MR. OWEN

OBJECTIVE TO WRITE A PROGRAM WHICH DEMONSTRATES THE BASIC I/O, ARITHMETIC, AND LOGIC STATEMENTS

1. THE PROBLEM - TO COMPUTE AN AMORTIZATION SCHEDULE GIVEN THE PRINCIPAL, PAYMENT, INTEREST RATE, AND THE NUMBER OF PAYMENTS PER INTEREST PERIOD
2. INPUT FORMAT
3. OUTPUT FORMAT
4. ROUNDING AND HALF ADJUSTING
5. COMPUTATION

PROJECT NONE

REFERENCE IBM 1620 MONITOR I, PAGES 95-111

* * *

FIRST AND SECOND YEAR JULY 20, 1965 230-430 MR. OWEN

OBJECTIVE TO CONSIDER THE PROBLEM PRESENTED JULY 19 AND ANY QUESTIONS DEVELOPED BY THE STUDENTS

PROJECT KEY PUNCH AND EXECUTE THE AMORTIZATION PROGRAM

REFERENCE IBM 1620 MONITOR I, PAGE 95-111

* * *

FIRST AND SECOND YEAR JULY 21, 1965 230-430 MR. OWEN

OBJECTIVE TO CONTINUE THE DISCUSSION OF PROBLEMS ASSOCIATED WITH THE AMORTIZATION SCHEDULE

PROJECT COMPLETE THE WRITING AND EXECUTION OF THE AMORTIZATION SCHEDULE WITH MODIFICATION

REFERENCE IBM 1620 MONITOR I, PAGES 95-111

* * *

FIRST AND SECOND YEAR JULY 22, 1965 230-430 MR. OWEN

OBJECTIVE TO STUDY THE SPECIFICATION AND USE OF SUBSCRIPTED VARIABLES

1. RELATIONSHIP OF SUBSCRIPTED AND NON-SUBSCRIPTED
    - EXAMPLES OF NON-SCRIPTED VARIABLES
    - X1, X2, X3
    - EXAMPLES OF SUBSCRIPTED VARIABLES
    - X(1), X(2), X(3), OR X(K) WHEN K=1 TO 3
2. SUBSCRIPTED VARIABLES USE TO HANDLE LARGE VOLUMES OF DATA. FOR EXAMPLE DO 10 J=1, 400 X(J)=0 SETS ALL VALUES OF X FROM X(1) TO X(400) EQUAL TO ZERO
3. DIMENSION STATEMENT
    - WHY IT IS NEEDED
    - ITS FORM
4. THE SUBSCRIPT
    - ITS FORM
    - ITS LIMITATION

PROJECT NONE

REFEREMCE IBM 1620 MONITOR I, PAGES 98-99

* * *

FIRST AND SECOND YEAR JULY 23, 1965 230-430 MR. OWEN

OBJECTIVE TO STUDY SUBSCRIPTED VARIABLES AND OTHER CONCEPTS ALREADY COVERED, AND TO INTRODUCE DO LOOPS

1. THE PROBLEM - TO WRITE A PROGRAM WHICH WILL COMPUTE THE MEAN OF GRADES READ FROM A CARD
2. INPUT-OUTPUT FORMAT
3. THE READ AND WRITE STATEMENTS
4. ACCUMULATING THE TOTAL

PROJECT COMPILE AND EXECUTE THE ABOVE PROGRAM

REFERENCE IBM 1620 MONITOR I, PAGES 106-107

* * *

FIRST AND SECOND YEAR JULY 26, 1965 230-430 MR. OWEN

OBJECTIVE TO CONSIDER ANY PROBLEMS RELATED TO THE PROJECT ASSIGNED AT THE PREVIOUS CLASS AND TO COMPARE LOOPING USING IF AND DO

1. REVIEW THE DO LOOP
2. WRITE THE EQUIVALENT PROGRAM USING A COUNTER AND AN IF STATEMENT

PROJECT COMPLETE THE ASSIGNMENT OF THE PREVIOUS CLASS AND TRY MODIFICATIONS SUCH AS DOUBLING THE NUMBER OF NUMBERS TO BE SUMMED

REFERENCE IBM 1620 MONITOR I, PAGES 102-104

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FIRST AND SECOND YEAR JULY 27, 1965 230-430 MR. DUERSTOCK

OBJECTIVE TO DISCUSS THE BASIC ORGANIZATION OF COBOL AS IMPLEMENTED ON THE IBM-7040 SYSTEM

1. NEED FOR BUSINESS LANGUAGE
2. PROGRAM SYSTEMS DEVELOPMENT
3. DIVISIONS OF COBOL
    - IDENTIFICATION
    - ENVIRONMENT
    - DATA
    - PROCEDURE
4. COBOL
    - CHARACTER SET
    - NAMES
    - CONSTANTS
    - VERBS
    - OPERATORS
5. IBM 7040/7044 COBOL WORD LIST
6. EXPRESSION
7. STATEMENT
8. SENTENCE
9. PARAGRAPH
10. SECTION

PROJECT NONE

REFERENCE IBM 7040/7044 OPERATING SYSTEM (16/32K) COBOL LANGUAGE, PP 1-6

****

FIRST AND SECOND YEAR AUGUST 2, 1965 230-430 MR. DUERSTOCK

OBJECTIVE TO STUDY IN DETAIL THE AREAS OF THE COBOL LANGUAGE

1. IDENTIFICATION DIVISION
2. ENVIRONMENT DIVISION
3. DATA DIVISION
    - CONFIGURATION SECTION
    - INPUT-OUTPUT SECTION
    - FILE SECTION
    - WORKING-STORAGE SECTION
4. FILE DESCRIPTION ENTRY
5. FILE TYPES
6. RECORD DESCRIPTION ENTRY
    - CLASS
    - SIZE
    - PICTURE
7. PROCEDURE DIVISION
    - OPEN

READ
MOVE
ADD
WRITE
CLOSE

PROJECT IBM 407 ACCOUNTING MACHINE PRACTICE PROBLEMS, 225-6109-1, PROBLEM 1

REFERENCE IBM 7040/7044 COBOL, PP 7-38

****

FIRST AND SECOND YEAR AUGUST 3, 1965 230-430 MR. DUERSTOCK

OBJECTIVE TO CONTINUE THE STUDY OF THE COBOL LANGUAGE

1. PAGE HEADINGS
    - WORKING-STORAGE SECTION
    - CONSTANTS
    - MAXIMUM SIZE
    - UNIQUE NAME--NO QUALIFICATION
    - 77 LEVEL
    - 01 LEVEL
2. IF STATEMENT
    - RELATION TEST
    - SIGN TEST
    - CLASS TEST
    - CONDITIONAL VARIABLE TEST
    - SWITCH-STATUS TEST
    - COMPOUND CONDITIONAL EXPRESSIONS

PROJECT PROBLEM 2

REFERENCE 7040/7044 COBOL, PAGES 23, 26-30

****

FIRST AND SECOND YEAR AUGUST 4, 1965 230-430 MR. DUERSTOCK

OBJECTIVE TO CONTINUE THE STUDY OF THE COBOL LANGUAGE.

1. COMPARING
2. MINOR TOTALS
3. SWITCH SETTING
4. EDITING
    - DECIMAL POINT PLACEMENT
    - ZERO SUPPRESSION

PROJECT PROBLEM 3

REFERENCE 7040/7044 COBOL, PAGES 18-20

* * *

FIRST AND SECOND YEAR AUGUST 5, 1965 230-430 MR. DUERSTOCK

OBJECTIVE TO CONTINUE THE STUDY OF THE COBOL LANGUAGE

1. GROUP PRINTING
    - INPUT
    - OUTPUT
2. MULTIPLE FILES
3. RENAMING OPTION
    - FILE-CONTROL PARAGRAPH
    - ASSIGN TO CLAUSE
    - 7040 SYMBOLIC-NAMES IN, OU, U01-U99

PROJECT PROBLEMS 4 AND 5

REFERENCE 7040/7044 COBOL LANGUAGE, PAGE 49

* * *

FIRST AND SECOND YEAR AUGUST 6, 1965 230-430 MR. DUERSTOCK

OBJECTIVE TO CONTINUE THE DISCUSSION OF PROBLEM 5 AND TO REVIEW THE PREVIOUS COBOL SUBJECTS

1. PROGRAM LOGIC
2. REVIEW
    - COBOL DIVISIONS AND SECTIONS
    - FILE-CONTROL CLAUSE
    - FILE DESCRIPTION ENTRY
    - DATA DESCRIPTION
    - EDITING FEATURES
3. PROGRAMMING TECHNIQUES
4. CLERICAL HINTS

PROJECT PROBLEM 5

REFERENCE 7040/7044 COBOL LANGUAGE, PAGES 1-49

* * *

FIRST AND SECOND YEAR AUGUST 9, 1965 230-430 MR. DUERSTOCK

OBJECTIVE TO CONTINUE THE STUDY OF THE COBOL LANGUAGE

1. FILE DESCRIPTION ENTRY
    - MULTIPLE OUTPUT FORMATS
    - MULTIPLE INPUT CARD FORMATS
2. EDITING
    - DOLLAR SIGN ON TOTAL ONLY
    - USE OF CR AND S SYMBOLS
3. SUBTRACTION

PROJECT PROBLEM 6

REFERENCE 7040/7044 COBOL LANGUAGE, PAGES 10, 13, 19, 20

FIRST AND SECOND YEAR AUGUST 10, 1965 230-430 MR. DUERSTOCK

OBJECTIVE TO CONTINUE THE STUDY OF THE COBOL LANGUAGE

1. GROUP PRINTING
2. MINOR AND INTERMEDIATE TOTALS
3. PROGRAMMING TECHNIQUES
4. ARITHMETIC STATEMENTS
    - ADD
    - SUBTRACT
    - MULTIPLE
    - DIVIDE
    - COMPUTE
5. CONDITIONAL EXPRESSIONS

PROJECT PROBLEM 7

REFERENCE 7040/7044 COBOL LANGUAGE PAGES 27-29, 31-38

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FIRST AND SECOND YEAR AUGUST 11, 1965 230-430 MR. DUERSTOCK

OBJECTIVE TO REVIEW SOME OF THE ELEMENTS OF THE COBOL LANGUAGE

1. COBOL REFERENCE FORMAT
    - MARGIN A-REQUIRED
        - DIVISIONS
        - SECTION-NAME
        - FILE DESCRIPTION ENTRY
        - PARAGRAPH-NAME
    - MARGIN A-PERMITTED
        - SUCCEEDING FD ENTRIES
    - MARGIN B-REQUIRED
        - LINES OF PARAGRAPH
2. ORGANIZATION OF SOURCE PROGRAM
3. LITERALS
    - NUMERIC
    - ALPHAMERIC
4. FIGURATIVE CONSTANTS

PROJECT NONE

REFERENCE 7040/7044 COBOL LANGUAGE, PAGES 1-55

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FIRST AND SECOND YEAR AUGUST 12, 1965 230-430 MR. DUERSTOCK

OBJECTIVE TEST COVERING THE COBOL LANGUAGE--WRITE A PROGRAM

1. DESCRIPTION OF INPUT DATA
2. DESCRIPTION OF OUTPUT FORM

PROJECT NONE

REFERENCE 7040/7044 COBOL LANGUAGE

MIAMI-DADE JUNIOR COLLEGE
COMPUTER CENTER
ADMINISTRATIVE AND INSTRUCTIONAL PERSONNEL

Theodore A. Koschler

Professor, Director of Computer Center
B.S., Bradley Polytechnic Institute, 1935, Mathematics and Science
M.S., Iowa State College, 1947, Industrial Education
Graduate work at M.I.T., University of Miami, University of Florida, Florida State University
Experience: 16 years administrative, 7 years teaching, 5 years military, 2 years industrial

David G. Owen

Associate Professor, Coordinator of Computer Science
B.S., George Peabody College for Teachers, 1950, Mathematics and Chemistry
M.S., Vanderbilt University, 1952, Chemical Engineering
Experience: 5 years teaching, 4 years military, 7 years industrial

Joseph A. Duerstock

Assistant Professor, Electronic Data Processing
B.B.A., University of Miami, 1965, Management
Experience: 3 years teaching, 3 years military

Charles C. Fridlin

Instructor, Systems Analyst
B.S., Purdue University, 1956, Economics
Experience: 6½ years industrial

A. Robert Poh

Associate Professor, Electronic Data Processing
B.S., Newark College of Engineering, 1954, Mechanical Engineering
M.S., University of Alabama, 1960, Engineering
Experience: 4 years teaching, 3 years military, 2 years industrial

Charles A. Leidlich, Jr.

Instructor, Electronic Data Processing
A.B., University of Miami, 1961, Geology
Experience: 1½ years teaching, 6 years military, 3 years industrial

MIAMI-DADE JUNIOR COLLEGE

11380 Northwest 27 Avenue
Miami, Florida 33167

COMPUTER CENTER

Laboratory Equipment

- IBM 082 Sorter (2)
- IBM 024 Card Punch (6)
- IBM 026 Printing Card Punch (3)
- IBM 519 Document Originating Machine
- IBM 077 Collator
- IBM 047 Tape to Card Punch with Keyboard
- IBM 407 Accounting Machine
- IBM 557 Interpreter, Model 80
- IBM 1620 Computer -- Central Processing Unit
  - 1632 Card Read Punch Adapter
  - 5514 Paper Tape Reader Adapter
  - 1021 Additional Instructions
  - 1285 Automatic Divide
  - 4650 Indirect Address
  - 2301 Core Storage Adapter
  - 1621 Paper Tape Reader
  - 1622 Card Read Punch
  - 1624 Tape Punch
  - 1623 Core Storage 20K Positions
  - 1311 Disk Storage Drive Adapter, Feature 3339
  - 1311 Disk Pack Drives and Packs (2)
  - 1627 Plotter
- IBM 1443 Printer & Adapter for IBM 1620
- Friden Flexowriter (2)
- Dura Machine 10 (1)
- IBM 407 Wiring Panels (30)
- IBM 519 Wiring Panels (21)
- IBM 077 Wiring Panels (16)
- Wiring Stands (30)
- Wiring Tables (16)
- *IBM 1401 Central Processor
- *IBM 1402 Card Read Punch
- *IBM 1403 High Speed Printer
- *IBM 7330 Magnetic Tape Drives (4)

*THIS COMPUTER COMPLEX IS AVAILABLE TO THE STUDENTS ON A PRE-PLANNED LIMITED BASIS AND LOCATED ADJACENT TO THE LABORATORY.

LIST OF AVAILABLE COLOR SLIDES

1.	1620 Central Processing Unit	3 Views
2.	1620 Central Processing Unit Lights	16 Views
3.	1622 Card Read/Punch	24 Views
4.	1620 Console Typewriter	5 Views
5.	1621 Paper Tape Reader	
6.	1622 Paper Tape Punch	
7.	1443 Printer	4 Views
8.	1311 Disk Drive	5 Views
9.	1311 Disk Pack	1 View
10.	026 Card Punch	11 Views
11.	Friden Flexowriter	1 View
12.	/360 Solid State Components	4 Views
13.	/360 Storage Unit's Capacity	
14.	/360 Selector and Multiplex or Channel	
15.	/360 Selector and Multiplex or Channel Operation	
16.	/360 Model 30 Card Read/Punch, Printer	
17.	/360 Data Cell	
18.	/360 Operating System Components	
19.	/360 Core Storage Components	

The above 35mm color slides were developed for use as a classroom introduction to the EDP equipment. Many of the multiple views outline a particular sequence designed to show specific relationships between the lecture subject and the hardware used.

JAD:ar
MDJC

11/2/65

APPENDIX

FORWARD

Eight student papers of general interest were selected for publication. These papers are in the following section and appear in their original form as submitted by the student.

The first six papers attempt to answer common questions posed by people interested in the data processing area. The subjects included cover an explanation of electronic data processing, a survey of jobs in the area, and a discussion of the application of EDP in Business, Science, Industry and Education.

Two term projects are included. These cover a comprehensive outline for an EDP course and a guide for the "hands on" approach to the teaching of the IBM 1620 Computer.

Other papers of a more specialized interest were completed by institute members. These papers will be held at Miami-Dade Junior College as part of the record of the 1965 Institute.

All individual student papers are listed as follows:

1. Gwendoly Z. Austin

   Documentation Requirements in a Computer Installation

2. John S. Draper

   Outline of A One Year Course of Study for Unit Record Equipment

   Data Processing As Used by Dade County in Position Control

3. Mary C. Durkin

   Data Processing Occupations

   Pupil Assignment Reports and Card Layout

   The Miami Herald Publishing Company Accounts Payable Procedure

4. William V. Durkin

    Scientific Applications of Data Processing

5. John M. Flannery

    The Scientific Option of Electronic Data Processing at Miami-Dade Junior College

    Development of a New EDP Course

    Analysis of an EDP System to Control Operating Costs

6. Robert H. Hosken

    The Miami-Dade Junior College Business EDP Option Outlining the Progression Through All EDP Classes As Well As the Inter-Relationships of the Other Course Requirements

7. Curtis J. Kinney

    Educational Applications of Data Processing

    A Guide For the Teaching of Data Processing

    Computer Applications of the Personnel Records of Jordan Marsh

8. Gary A. Luing

    Commercial Applications of Data Processing

    Computation of a 5-, 10-, and 20-Day Moving Average

    Course Outline for a One Week EDP Seminar

9. Robert F. Martin

    Industrial Applications of Data Processing

10. William Ross Odom

    The Feasibility Study

11. James B. Petrea

    Job Availabilities in Data Processing

12. Eugene J. Redig

    SPS Income Statement

    Fortran Income Statement

    Method of Inventory Control of Food Fair Stores, Incorporated

13. **William E. Saul**

Electronic Data Processing For the Prospective Student

ELECTRONIC DATA PROCESSING FOR THE PROSPECTIVE STUDENT

William E. Saul

August 6, 1965

ELECTRONIC DATA PROCESSING FOR THE PROSPECTIVE STUDENT

Statement of the Problem:

> Much has been written and said about data processing. What is data processing and how would a prospective student be able to determine whether to enroll in a school that has a data processing curriculum? Will there be a need for trained people in data processing in the future?

I. Electronic data processing--what was it?

Electronic data processing has been catapulted into prominence the past two decades and the industry is looking forward to more phenomenal growth. Perhaps the only thing that is relatively new is the word electronic. Data processing is not new. It has been going on for centuries.

The historical growth may be traced as man developed new ways of counting: fingers, toes, stones, the abacus, Pascals' gear driven computer, Leibnitzs' arithmetic computer that could add, subtract, multiply, and divide, Babbages' "difference engine" which was the first of the giant computers, and Dr. Hollerith who built a card machine and added the magic of electricity and building in essence the first electrical computing machine to assist in the taking of the 1890 census.

II. Electronic data processing--what is it now?

The processing of data by electronic equipment has created vast changes in business and industry. Nowhere are these changes more apparent than in the occupations associated with the handling of business information. Much of the routine time-consuming work of obtaining, compiling, and reporting the information necessary for a business to operate can now be adapted to machine processing. As a direct result, the educational requirements for many businesses have changed considerably. This is especially true of those occupations which require training beyond that provided by the general high school curriculum.[1]

Typical business applications of data processing systems are for payrolls, maintenance of accounts, billing, report preparation, stock recording and inventory control, and sales analysis.[2]

While the average person may be impressed by the information handling ability of the modern equipment, he certainly does not or should not ascribe any supernatural qualities to the machines, nor does he feel particularly apprehensive about the effect of such machines on society. Computers are not generally regarded with such equanimity. These remarkable machines have been thrust into the public view with a barrage of true, half-true, and false statements.[3]

The manufacturers of electronic data processing equipment are gearing their products to serve all kinds of businesses, from the very small to the extremely large. Machines do about 7 percent of all office work in 1962: the goal of computer manufacturers is 5 times that![4]

Data processing systems can digest large volumes of data at high speeds, but their data must be fed to them in machine language. To date, information in printed form has to be converted to machine language by human operators as a preliminary to machine processing.[5]

Today's large-scale computers help to make airplanes faster and safer. They help build automobiles. Guided missiles and space vehicles owe their very existence to electronic computers. Gigantic payrolls are prepared by machines. Computers forecast weather, design ships, control industrial processes, run machine tools, and solve tremendously complex business problems for private and governmental organizations.[6]

Is data processing going to be an easy addition to my knowledge? Yes and no. Yes, if all you want to do is add a little vocabulary and background. No, if you believe that you have to have a good understanding of data processing yourself and that you must stay reasonably up-to-date in it. Data processing encompasses a lot of knowledge even in a specialized area such as accounting. And to stay up-to-date is a hard job even for persons working in the field.[7]

III. What courses are available at Miami-Dade Junior College in Data Processing?

The development of new equipment with greater capability and capacity for solving scientific, engineering, and business problems has created a demand for technicians in the information processing field.

Two options--Scientific and Business--are open to the student. In either option the student will acquire, through classroom and laboratory experiences using up-to-date equipment, an understanding of the basic principles of operating and programming modern electronic digital computers. The curriculum for both options also includes classroom and laboratory courses in the operation and panel wiring of other types of equipment normally found in scientific and business data processing installations.

In addition to these courses, the Scientific option emphasizes class work in scientific and engineering subjects, while the Business option stresses the business subjects.[8]

The two options both encompass a two-year program of concentrated study with approximately 72 semester hours of work. Of the 72 semester hours required, both options share a similarity of course offerings that total 21 hours. These 21 semester hours are listed below:

DIGITAL COMPUTER THEORY		3
PUNCH CARD MACHINES		3
PROGRAMMING A SOLID STATE, CORE MEMORY COMPUTER		3
THE ACCOUNTING MACHINE		3
PROGRAMMING DIGITAL COMPUTERS		3
ADVANCED COMPUTER PROGRAMMING		3
STATISTICS		3
	TOTAL	21 Semester Hours

IV. Data Processing in the future.

Although computers have been improved, each new model better than the one that preceded it, most experts are in agreement that they do not think.

Mundy Peale, president of Republic Aviation Corporation, addressing a committee studying the future of manned aircraft, had this to say: "Until someone builds, for $100 or less with unskilled labor, a computer no larger than a grapefruit, requiring only a tenth of a volt of electricity, yet capable of digesting and transmitting incoming data in a fraction of a second and storing 10,000 times as much data as today's largest computers, the pilots of today have nothing to worry about."[9]

The human brain is obviously a thing of amazing complexity and fantastic ability. Packed into the volume Mr. Peale described are some 10 billion neurons, the nerve cells that seem to be the key to the operation of our minds. Hooked up like some ultra-complicated switchboard, the network of interconnections stores an estimated 200,000,000,000,000,000,000 bits of information during a lifetime! By comparison, today's most advanced computers do seem pathetically unimpressive.[10]

As population grows and business expands in physical size and complexity, it is obvious that the computer and its data-processing ability will be called upon more and more. There is another factor, that of the internationalizing of business. Already planners are talking worldwide computerized systems.

As a mathematical whiz, the computer will relieve us of some of our money worries. Coupled with a credit card, a central computer will permit us to make purchases anywhere in the world and to credit our account with wages and other income. If we try to overdraw, it may even flash a warning light as fast as we put the card in the slot.

Of more importance than merely doing bookkeeping is the impact the computer will have on the planning and running of business. Operations research, implemented by the computer, will make for more efficient businesses. Decisions will increasingly be made not by vice-presidents but by digital computers.

Business is tied closely to education, and we have had a hint of the place the computer will make for itself in education. The computer has also proven itself as a patent searcher, a composer of music, storing of vast quantities of information for recall in the fields of medicine, law, engineering, libraries, and the metal industry.

The third generation of computers have been developed to have multi-processing capabilities. This means that they can be working on several programs simultaneously. Remote inquiry is another rapidly developing field whereby it is possible to have computers separated by many miles in distance converse with each other and transmit information from each other through the use of a leased telephone or telegraph line.

The United States Department of Labor expects the use of electronic data-processing equipment to increase very rapidly throughout the remainder of the 1960's and, as a result, the number of jobs for operators will also increase rapidly. In addition, some openings will occur as operators of computer systems transfer to other kinds of work or stop working for other reasons. As in the past, employers will fill some of the openings by training people already in their employ, but many other positions will be filled by hiring outsiders who demonstrate an aptitude for this kind of work.

More important, perhaps, than the total number of openings likely to occur is the possibility that job requirements may change in this very new field of work. Computer systems are constantly being modified and, along with these changes, the duties of console and auxiliary equipment operators are also changing. If operating a computer console continues to require the special aptitudes now often needed, employment opportunities will be very good for the comparatively limited number of candidates who can qualify.

Information about the salaries of computer operating personnel in over 500 companies throughout the country is available from a private survey conducted in 1962. The average salary for beginning console operators was about $85 a week. Operators with more experience generally earned from $95 to $105, and senior console operators and others with supervisory responsibilities earned between $115 and $135 a week. The salaries of peripheral equipment operators working with high-speed printers averaged $95 a week; and for tape librarians, the average was about $90.[11]

Employers who use computers to process business records generally place somewhat less emphasis on the need for college training. Many regard previous experience in related work--in machine tabulation, for example, or in payroll work or accounting--equally important and fill many of their programmer positions by promoting qualified employees with such experience. However, when they find it necessary to hire outsiders, an increasing number give preference to applicants with education beyond high school. They regard college courses in the general field of electronic data processing, or in accounting, business administration, engineering, and mathematics as especially good preparation.

Most programmers starting out on the job attend training classes for a few weeks and then, as they work on minor programming assignments, continue with further specialized training. A year or more of experience is usually necessary before a programmer can handle all aspects of his job without close supervision. Once he becomes skilled at it, his prospects for further advancement are good. An experienced and capable programmer in an organization, employing several people in this occupation may move up to a senior job with supervisory responsibilities. Promotion to a position as methods analyst may also be possible. Still other programmers may advance to management positions with their firms.[12]

Data processing is a dynamic and growing facet of our economy. Applications are multiplying rapidly in the fields of business, science, industry, and education. In order to train for entry into this expanding field, Miami-Dade Junior College offers training in the Scientific and Business subject areas.

BIBLIOGRAPHY

[1] U.S. Department of Health, Education, and Welfare. *Electronic Data Processing--1*. Washington: U.S. Government Printing Office, 1963. p. iii.

[2] "Data Processing," McGraw-Hill Encyclopaedia of Science and Technology, Vol. IV., 1960. p. 13.

[3] *Business Systems*. 2 vols. Cleveland: Systems and Procedures Association, 1963. 19-3.

[4] Halacy, D. S., *Computers, The Machines We Think With*. New York: Dell Publishing Co., Inc. 1964. p. 231.

[5] "Data Processing," McGraw-Hill Yearbook of Science and Technology, Vol. XV, 1962. p. 149.

[6] Fahnestock, James D., *Computers and How They Work*. New York: Ziff-Davis Publishing Co., 1959. p. 140.

[7] Gibson, E. Dana, "Data Processor For Better Business Education," Vol. V, No. 2, November 1964. p. 10.

[8] Miami-Dade Junior College, Bulletin 1964-65. Vol. I, No. 1, July, 1964. pp. 61-62.

[9] Halacy, *op. cit.*, p. 120.

[10] Halacy, *op. cit.*, p. 120.

[11] U.S. Department of Labor. *Employment Outlook for Electronic Computer Operating Personnel Programmers*. Washington: U.S. Government Printing Office, 1963-64. p. 3.

[12] *Ibid.*, p. 2.

DATA PROCESSING OCCUPATIONS

MARY C. DURKIN

8 August, 1965

DATA PROCESSING OCCUPATIONS

Statement of the Problem:

The purpose of this paper is to discuss and classify data proce job opportunities.

OUTLINE

I. Questionaire - Ten Corporations

II. Job obsolescence

III. New Jobs

- A. Tabulating Clerk
  1. Key Punch
  2. Tape writing
  3. Control Clerk
  4. Key Punch Supervisor
- B. Peripheral Equipment
  1. Unit Record Equipment
  2. Converter Operators
  3. Accounting Machine
  4. Tabulating Operations Supervisor
- C. Electronic Computer Operating Personnel
  1. Console Operator
     - a. Computer Operator - C.
     - b. Computer Operator - B.
     - c. Computer Operator - A.
     - d. Senior Computer Operator.
     - e. Lead Computer Operator.
     - f. Manager of Computer Operations.
- D. Records Management
  1. Tape Librarian
  2. Manager Retrieval System

E. Programming

1. Programmer - C.
2. Programmer - B.
3. Programmer - A.
4. Senior Programmer
5. Lead Programmer
6. Manager of Programming

F. Systems Analysis Section

1. Systems Analyst - C.
2. Systems Analyst - B.
3. Systems Analyst - A.
4. Senior Systems Analyst
5. Lead Systems Analyst
6. Manager of Systems Analysis

G. Department Control

1. Work Process Scheduler
2. Coordinator of Data Processing
3. Technical Assistant to the Manager
4. Assistant Manager of Data Processing
5. Manager of Data Processing

H. Maintenance

1. Electronics Technician IV. - Junior
2. Electronics Technician I.
3. Computer Maintenance Technician
4. Draftsman

IV. What the Business Employee Should Know about Automation

V. What the Business Employee Should Do about Automation

VI. The Role of Education

1. In Transition
2. Future
3. Traditional

I. Questionaire - Ten Corporations. The Christian Century reports on a questionaire they originated with the purpose of finding out about automation and the effect it would have on the work force during the next decade.[1] The following ten corporations were selected:

The Bank of America
United Air Lines
Pacific Telephone & Telegraph
Aitcheson, Topeka & Santa Fe Railway
Pacific Gas & Light Company
Shell Oil Company
Douglas Aircraft
Aerojet
Rohr Aircraft
North American Aviation

The questions with the collective responses were:

Q. To what extent is the firm automated?
A. Firm in from the beginning of business automation, now accelerating.

Q. What problems have been created by automation?
A. None (most corporations) or minor procedural (some corporations.

Q. Do you anticipate a decreased work force as a result of automation?
A. No.

Q. How does work force compare with previous work force?
A. It has increased.

Q. In what way have skill requirements increased as a result of automation?
A. The ratio of skilled to unskilled workers is up, and production line workers have gone down. New career fields in research and operations have been created. Requirements are much higher.

Q. What are your doing to prepare your employees for the impact of further automation?
A. On the job training programs. Returning high echelon personnel to the universities for retraining.

II. Job Obsolescence. John Diebold in his article, "When will your Husband be obsolete?"[2] listed the following dead-end jobs:

bank worker (clerical), electric-power plant worker, elevator operator, grocery store owners and clerks, mail clerks, meter readers, painters, service station attendents, unskilled workers.

Jobs not going anywhere, he listed as follows:

accountant, advertising man, automobile mechanic, baker, bank management, bricklayer, comptrollers, cooks, motel and hotel management, laundry and dry cleaning proprietors, mail-carriers, motion picture projectionists, personnel manager, plasterers, policeman, public relations personnel, purchasing agent, repairmen - T.V., appliances etc., travel agent, truck driver, warehouseman.

Bright-future jobs he lists as:

Athletic directors, attorneys, many engineers, communication equipment installers and service workers, computer maintenance workers, computer operators, computer programmers, consultants to management, data processing systems analyst, economists, insurance actuaries, insurance agents and brokers, marketing research workers, mathematicians, medical technicians, operations researchers, quality control engineers, teachers, telephone installers, writers and editors.

Even in the field of data processing some of the presently classified jobs will no longer exist in the next decade. Better ways of capturing and storing data will be used. This will place the key punch operator in a dead-end occupation. Tape librarians will be replaced by retrieval management experts.

The answer to this would appear to be continual education, the employee keeping up-to-date with developments in his occupational field.

III. New Jobs.

A. Tabulating Clerk [3]

1. Key Punch
2. Tape Writing

Under direct supervision operates key punch or tape writing machine. Ability to record data on punch cards or tape from source material. Speed and accuracy important. A knowledge and understanding of basic data processing language helpful.

3. Control Clerk
4. Key Punch Supervisor

The control clerk has the responsibility of checking output against job requirements. A knowledge of bookkeeping and skill in typewriting part of educational requirements. The key punch supervisor has the responsibility of directing the key punch operation. Ability to prepare program cards for different operations necessary.

B. Peripheral Equipment[3]

1. Unit Record Equipment
2. Converter Operators
3. Accounting Machine

Tab operators, as they are commonly called, must have ability to understand the complexities of various machines. May assist the supervisor in the wiring of plugboards, reading wiring diagrams, and must know how to interpret signals from a panel of lights on the machine. A knowledge of business reports is necessary for the accounting machine operator. The convertor operator should have a knowledge of the whole computer system in order to prevent errors from stopping the work flow.

4. Tabulating Operations Supervisor

Under general direction carries out the responsibilities of supervising the activities of the tabulating section. Gives direction and guidance to lower level classifications.

C. Electronic Computer Operating Personnel[4]

Console Operator

a. Computer Operator - C. Under immediate supervision, carries out minor duties in accordance with detailed instructions. Usually works on only one activity under very close direction with the work being carefully checked. Carries out various activities of a training nature concerned with all activities usually concerned with the "B" level classification. This classification is usually filled by beginners in computer operations who have sufficient educational background and/or experience to qualify them to start in computer operations.

b. Computer Operator - B. Under direct supervision, assists high level classifications in monitoring and controlling an electronic computer. Usually fairly competent to work on several phases of computer operations with only general direction but still needs some instruction and guidance for the other phases. Manipulates control switches on control panels, storage devices, printers, readers and punches in accordance with detailed instructions. Assists higher level classifications in carrying out the various duties associated with operating a computer in connection with the computer itself or the auxiliary equipment directly associated with the computer. May keep records regarding output units and maintain records for stores and supplies.

c. Computer Operator - A. Under direct supervision, monitors and controls an electronic computer on established routines. Usually competent in most phases of computer operations to work on his and only requires some general direction for the balance of the activities. Assists high level classifications in determining equipment settings and operating instructions. Manipulates control switches on console panel in accordance with established routines or under instructions. Observes continuously the lights on the control panel, the magnetic tape units,and the like, reporting to supervisors any deviations from standard. May assist higher level classifications in manipulating controls to rearrange sequence of program steps to correct computational errors or to continue operations when individual units of system malfunction. Assists in maintaining operating records.

d. Senior Computer Operator. Under general supervision, monitors and controls an electronic computer by operating the central console. Usually competent to work at highest level of all computer operations phases while working on his own most of the time. May give some direction and guidance to lower level classifications. Studies program operating instructing sheets to determine equipment setup and run operation. Switches auxiliary equipment into circuit. Manipulates control switches on console panel to start and operate the computer. Observes continuously the lights on the control panel, storage devices, printers, readers, punches, and the action of the automatic typewriter to monitor the system and determine the point of equipment or program failure. Manipulates control in accordance with standard procedures to rearrange sequence of program steps in order to correct computational errors or to continue operations when individual units of the system malfunction. Confers with technical personnel in the event errors require a change of instructions or sequence of operations. Maintains operating records such as machine performance and production reports.

e. Lead Computer Operator. Usually considered as the assistant manager, or has full technical knowledge of computer operations comparable to a senior but also has supervisory duties of instructing, assigning, directing and checking the work of the other computer operators, including the seniors. Assists in the scheduling of the operations and the assignment of personnel to the various items of equipment required for the computer functions. Coordinates activities of the section with other sections of the over-all data processing department. May act for the supervisor of the computing operating section in his absence.

f. Manager of Computer Operations. Plans, organizes and controls the computer operations section in the operation of the computer and perpheral data processing equipment. Usually considered as being in full charge of all activities of equipment operations. Establishes detailed schedules for the utilization of all equipment in the computer operations section to obtain maximum usage. Assigns personnel to the various operations and instructs them when necessary so that they are trained to perform assigned duties in accordance with established methods and procedures. Collaborates with personnel in other data processing sections to coordinate activities. Reviews equipment logs and reports to the Manager of Data Processing on equipment operation efficiency for the section.

D. Records Management

1. Tape Librarian. The responsibility of the librarian is to classify and code information as to its content of data. Experience in business records management and standard rules of storing data for immediate retrieval necessary. Under direct supervision maintains active files, retires inactive.

2. Manager Retrieval System. Responsible for the maintenance and supervision of records management section. Reports to the Manager of Data Processing on storage and retrieval problems. Must have knowledge of computer operations and evaluate and modify existing files to take into account changes in system requirements or equipment configurations.

E. Programming

1. Programmer - C. Under immediate supervision, assists higher level classifications in the analysis of detailed systems specifications and the preparation of program instructions. All work is performed under close supervision. This classification is usually staffed by beginners in computer programming who have had sufficient educational background and/or experience to qualify them to start in computer programming.

2. Programmer - B. Under direct supervision, assists in the review and analysis of detailed computer systems specifications and the preparation of the program instructions. Usually fairly competent to work on several phases of programming with only general directions but still needs some instruction and guidance for the other phases. Assists in, and in some cases carries out on his own the preparation of all levels of block diagrams and machine logic flow charts. Codes program instructions. Assists in preparing test data and testing and debugging programs. Assists in the documentation of all procedures used throughout the system.

3. Programmer - A. Under general supervision, analyzes and defines detailed computer systems to develop programs for electronic data processing. Usually competent in most phases of programming to work on his own and only requires some general direction for the balance of the activities. Conducts detailed analysis of all defined systems specifications and develops all levels of block diagrams and machine logic flow charts. Codes, prepares test data, tests and debugs programs, revises and refines programs as required and documents all procedures used throughout the computer program when it is formally established. Evaluates and modifies existing programs to take into account changes in systems requirements or equipment configurations. May give technical assistance to lower level classifications.

4. Senior Programmer. Under general supervision, develops and prepares machine logic flow charts for the solution of business, engineering and/or scientific problems through the use of electronic data processing equipment. Usually competent to work at the highest level of all technical phases of programming while working on his own most of the time. May give some direction and guidance to the lower level classifications. Analyzes problems outlined by systems analysts in terms of detailed equipment requirements and capabilities. Designs detailed machine logic flow charting. Verifies program logic by preparing test data for trial runs. Tests and debugs programs. Prepares instruction sheets to guide computer operation during production runs. Evaluates and modifies existing programs to take into account changes in systems requirements or equipment configurations. May translate detailed machine logic flow charts into coded machine instructions. May assist in determing the causes of computer operation malfunctions. May confer with technical personnel in systems analysis and application planning.

5. Lead Programmer. Usually considered as the assistant manager, or has full technical knowledge of programming comparable to a senior but also has supervisory duties of instructing, assigning, directing and checking the work of the other programmers, including the senior programmers. Assists in scheduling programming projects and in the assignment of personnel to the various projects. Coordinates the activities of the programming section with the other sections in the overall computer department. May act for the supervisor of the programming section in his absence.

6. Manager of Programming. Plans, organizes and controls the preparation of computer programs for the solution of business, scientific and/or engineering problems through the use of electronic data processing equipment. Usually considered as being in full charge of all programming activities. Assigns, outlines and coordinates the work of programmers engaged in writing computer programs and routines. Establishes the standards for block diagramming, machine flow charting and pro-

gramming procedures. May write and debug complex programs. reviews and evaluates the work of the staff and prepares periodic performance reports. Collaborates with systems analysts and other technical personnel in scheduling equipment analysis, feasibility studies and systems planning.

F. Systems Analysis Section

1. Systems Analyst - C. Under immediate supervision, carries out analyses of a less complex nature as assigned and instructed. Usually works only on one activity under very close direction with the work being closely checked. Prepares functional process charts to describe existing and proposed operations. Designs detailed record and form layouts. Details computer block diagrams to reflect specific computer procedures. May assist in the preparation of machine logic flow charting. This classification is usually staffed with beginners in systems analysis who have had a sufficient educational background and/or experience to qualify them to start in systems of analysis.

2. Systems Analyst - B. Under direct supervision, assists higher level classifications in devising computer system specifications and record layouts. Usually fairly competent to work on several phases of systems analysis with only general direction but still needs some instruction and guidance of higher levels for the other phases. Studies and analyzes existing office procedures as assigned. Prepares systems flow charts to describe existing and proposed operations. Prepares comprehensive computer block diagrams in accordance with instructions from higher level classifications. May assist in the preparation of machine logic flow charting.

3. Systems Analyst - A. Under general supervision, determines computer system specifications and record layouts and develops procedures to process information by means of electronic data processing equipment. Usually competent in most phases of systems analysis to work on his own and only requires some general direction for the balance of the activities. Confers with organizational personnel to determine the problem and type of data to be processed. Analyzes problems in terms of systems requirements, and modifies the systems design to take the maximum advantage of the existing data processing equipment. Where necessary, recommends equipment modifications or additions to enable an efficient and effective systems application. Prepares a definition of the problem together with recommendations for the equipment needed for its solution from which programming prepares machine logic flow charting and machine instructions. Advises and consults on the implementation of systems applications. Devises data verification methods and standard systems procedures. Prepares computer block diagrams. May assist in the supervision and preparation of machine logic flow charting.

4. Senior Systems Analyst. Under general direction, formulates logical statements of business and scientific problems and devises procedures for solutions of the problems through the use of electronic data processing systems. Usually competent to work at the highest level of all technical phases of systems analysis while working on his own most of the time. May give some direction and guidance to lower level classifications. Confers with officials, scientists and engineers, to define the data processing problem. Prepares tables and diagrams to assist in analyzing problems, utilizing, if necessary, various business, scientific and/or engineering mathematical techniques. Devises logical procedures to solve problems by electronic data processing keeping in mind the capacity and limitations of equipment, operating time and form of desired results. Analyzes existing system logic difficulties and revises the logic and procedures involved as necessary. Develops logic and procedures to provide more efficient machine operations. Prepares computer block diagrams. May assist in the supervision and preparation of machine logic flow charting.

5. Lead Systems Analyst. Usually considered as the assistant manager, or has full technical knowledge of the activity comparable to a senior but also has supervisory duties of instructing, directing, and checking the work of the other systems analysts, including the senior systems analysts. Assists in planning, organizing and controlling the activities of the section. Assists in the scheduling of work and the assigning of personnel to the various projects being studied or processed. May coordinate the activities of the section with other sections or departments. May act for the manager in his absence.

6. Manager of Systems Analysis. Plans, organizes and controls the activities of the Systems Analysis Section in the establishment and implementation of new or revised systems and procedures concerned with electronic data processing. Usually considered as being in full charge of all systems analysis activities. Responsible for feasibility studies and systems design involving electronic data processing and makes recommendations on the action to be taken. Assigns personnel to the various projects and directs their activities. Consults and advises other departments on systems and procedures. Coordinates section activities with the activities of other sections and departments. Prepares activity and progress reports regarding the activities of the systems analysis section.

G. Department Control

1. Work Process Scheduler. Under general direction, schedules operating time of the over-all electronic data processing activities in order to ensure that the data processing equipment is effectively and efficiently utilized. Responsible for keeping unutilized time to a minimum by maintaining liason with section managers and reassigning unused time. Coordinates preventive

maintenance requirements with operating requirements.

2. Coordinator of Data Processing. Under general direction, coordinates the activities of the electronic data processing operations with the organizational departments. Usually only has departmental staff responsibility. Assists in establishing systems analysis, programming, and computer operations priorities in order to provide effective service to all users. Recommends standard policies and procedures for providing routine service. Maintains contacts with all using departments, other management services, and computer department sections to coordinate activities for the best results with the least possible delay. Participates in evaluating the contribution of the electronic data processing operations to the over-all organization program, improving the service where and when possible, and extending its use where feasible.

3. Technical Assistant to the Manager. Under general direction, provides technical assistance for planning and directing the installation, and the modification and operation of electronic data processing systems. Analyzes proposed and actual project in terms of machine capabilities, costs and man and machine hours to determine the feasibility of electronic data processing. Usually has only departmental staff responsibility. Plans and recommends machine modifications or additional equipment to increase the capacity of the system. Prepares cost estimates for current and proposed projects, reflecting the cost of equipment and man and machine hours required. Directs compilation of records and reports concerning production, machine malfunctioning, and maintenance. May advise or consult with manager, section managers and other departments on organizational procedural and work-flow plans. May apply knowledge of higher mathematics, operations research, statistical analysis, or numerical analysis techniques to solve business and technical problems.

4. Assistant Manager of Data Processing. Under general direction, assists the manager in planning, organizing and controlling the various sections of the department. Usually has departmental line responsibility but in certain instances may only have departmental staff responsibility. Participates in research and procedural studies. Develops analyses on existing and newly developed equipment and techniques. Consults with and advises other departments with regards to feasibility, systems and procedures, and records control studies and problems. May act for the manager in his absence.

5. Manager of Data Processing. Plans, organizes and controls the over-all activities of electronic data processing including systems analysis, programming, and computer operation activities through managing subordinates or by direct supervision. Personally handles major personnel, administrative and data processing problems. Maintains continuous control of all activities under his direction through management reports and direct super-

vision. Confers with and advises subordinates on administrative policies and procedures, technical problems, priorities and methods, and through subordinate supervision is responsible for the over-all direction of the various functions to ensure that the activities assigned are completed in the most competent, effective and efficient manner. Consults with, advises, and coordinates between his groups and other departments as necessary for the proper integration and correlation of the functions and activities assigned. Reports to high level middle management and/or top management on data processing plans, projects, performance, and related matters.

H. Maintenance

1. Electronics Technician IV. - Junior. Routine work such as wiring, assembly, or simple testing. Usually directly out of high school.

2. Electronics Technician I. Usually competent to perform work in circuit design, equipment layout, test and data evaluation on basis of minimal information supplied by engineer, with whom he works on a partnership basis rather than supervised.

3. Computer Maintenance Technician. Usually qualified to diagnose equipment defects and to repair, test, install, and adjust any component or module in either computers or peripheral equipment.

4. Draftsman. May work on electrical or mechanical projects. A junior draftsman assists the detailer draftsman by doing repetitive tasks, copy work, inking, lettering, crosshatching, and filling.

IV. What the business Employee should know about Automation. In ten years job types will change a great deal. The emphasis will be on data communication equipment and methods, also information storage and retrieval systems other than punched cards and paper tape. Knowledge will be more international in character as world-wide T.V. programs become available in the next two or three years. There will be the beginning of hugh information utility groups, both private and publicly owned. Centralized depositories of information will be necessary with thousands of interrogation units scattered throughout the world. The person who gets into this work will move up with the natural growth to come. Employees who can interpret data and who can manage various areas of data operations will have more or less permanent jobs.

Leisure is another problem with which the person on a shorter work week will be faced. Many people will return to school, especially those below 40 years of age. People above this age will look forward to an early retirement. Companies will provide bigger pensions as an incentive for early retirement. This will reduce work forces without having to fire people, that is by attrition.

V. What the Business Employee should do about Automation. If he is willing to change there are several things he can do:

1. Find our what kind of future his job has.
2. Begin to take courses that will provide some understanding of automation.
3. Read everything possible on the subject.
4. Become acquainted with different automated installations.
6. Decide the next job he will do if his present job is to be automated from under him.
7. Begin getting ready for the new job.
8. If near the age of retirement, get ready for this time financially and mentally.

VI. The Role of Education.

1. In transition. In 1963, Dean William J. Hoben of the School of Business Administration at the University of Dayton, Ohio, charged a faculty committee on Automation and Data Processing to investigate and answer certain questions with regard to Data Processing.

After extensive discussions with business leaders, equipment manufacturers and other educators the following recommendations were made:

a. That all business students be exposed to data processing as soon as possible in school.
b. That they may be familiar with data processing as a tool.
c. That general education should be the primary objective in undergraduate school, and therefore, a major is not recommended at the present time.
d. That two hours of automated accounting be required of all business students.
e. That an additional six semester hours of advanced work be offered at the graduate level in systems and design concerned with computing systems, for those who desire this field of specialization.

The business community is looking for students who can bridge the gap during the transition of the next ten years. He must be well grounded in the business subjects, he must be a creative thinker, and bring new methods to be applied to business problems.

2. Future. The responsibility of public high schools would seem to lie in the area of providing such education as would allow the prospective employee to adjust to situations in all kinds of installations. Preparation in high school will have to be of the kind that will provide the students with fundamental skills and knowledges that would give the students flexibility in seeking employment. The program would emphasize to the student that rapidly developing digital computer technology causes changes in duties, and that to stay employed he will have to become involved in continuing eduation programs.

3. Traditional. At the present time the indications are that students in the clerical tracks are receiving adequate education for entry into the data processing field. The Clerical Office Practice Courses are desirable capstone courses because they contain units of work which pertain to duties performed by clerical workers in business data processing.

Courses which apparently have a high job utility for persons in clerical positions in business data processing are:

a. Courses in English Grammer.
b. Courses in Mathematics, particularly Algebra.
c. Courses in Bookkeeping and Accounting.
d. Courses in Beginning and Advanced Typewriting.
e. Courses in Office Machines.

REFERENCE LIST

[1] "Ten Corporations and Automation" *The Christian Century*(March 3, 1965).

[2] John Diebold, "When Will Your Husband Be Obsolete?" *McCall's* (1963).

[3] Adaline D. Jone, Ph.D., "Knowledges and skills needed in Data Processing Occupations" *DATA PROCESSOR*(April, 1965).

[4] "Computer Personnel Positon Descriptions" *Computer Personnel Consultants, Inc*.(1963).

THE APPLICATION OF COMPUTERS IN BUSINESS

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THE APPLICATION OF COMPUTERS IN BUSINESS

The application of computers in business is a new concept. In 1954 only one electronic computer was in use processing business transactions! Eight years later, in 1962, it was estimated that 6,000 electronic computers were in use in business; from 1962 to 1963 that number had more than doubled![1] In their latest survey, Business Automation placed at 21,598 the total number of computers in the United States. Computer utilization has now progressed from its former role of primarily a mass clerical processing device to the more prestigious and profitable role of solving management problems. From the application of EDP, the modern businessman may realistically hold great expectations. Such expectations include:

1. Improved control over the business as a result of a more efficient reporting system.
2. Reduction of inventory and receivables thereby reducing working capital needs.
3. Faster and more accurate clerical and accounting paperwork and savings in the cost thereof.
4. More effective planning through the study of alternatives not practical without the computer.

This paper presents a discussion of approaches taken by business to realize these expectations.

TOTAL AND FUNDAMENTAL INFORMATION SYSTEMS

"An information system may be defined as the procedures, methodologies, organization, software, and hardware elements needed to insert and retrieve selected data as required for operating and managing a company."[2] In systems selection, data processing specialists today are proposing two alternatives in concept. These two concepts are the "total" information system, based, as the name implies, upon the "total systems" approach, and the "fundamental" information system, based upon the "single information flow" philosophy. The total information system represents an extension of the present subsystems approach and attempts to unite all existing information subsystems in a company into a single combined system. The fundamental information system, however, is limited to data which is deemed absolutely essential to the company's operation. Other data, less pertinent, but needed for one reason or another by specific user groups, is recorded and handled outside of the fundamental information system.

The total system approach is particularly appropriate to manufacturing concerns. The first elements of the system are the customer orders. These incoming orders are fed into the computer. This information, in turn, triggers an allocation of material and labor, inventories are properly adjusted, payments and bills mailed, production schedules adjusted, work standards and measurements checked, and quality control determined. Completed production steps lead to the automatic preparation of shipping documents, and on to the billing and accounts receivable operations, all performed on the computer. Finally, at the end of the month, the computer gathers the accounting information together and prints budget comparison reports and financial statements for review by management.[3]

From the above, it is apparent that data processing has far greater implications upon accounting than merely providing for high-speed bookkeeping. Such things as inventory control, cost of manufactured products, sales and accounts receivable billings, budgets and operating forecasts are all well within the data processing realm. Since it has been estimated that an electronic computer will make no more than one error to every 10,000 human errors, it is obvious that the greater accuracy factor will be of significant value in financial matters. High-speed computers capable of accumulating, processing, and storing masses of data are providing the accountant with control over awkward operating areas within which there has previously been little or none. This and other improvements brought about by electronic computer utilization has expanded the accounting process and made it a more useful and encompassing tool.

This total approach has not been attempted by many organizations. The major reason for its limited adoption is an economic one. A system of this size and complexity is naturally costly, and not many firms have been able to justify the outlay involved. Also, there are some aspects of the total system concept which require further streamlining. The total system approach, however, is certainly here to stay. Like other EDP business applications, it will likely become an integral part of most big corporations within the next ten years.

The complexity of modern business has placed ever-increasing demands upon management; management, in turn, is placing itself in the capable hands of business-oriented computers and the ultimate total information system. Not only does a total system generate a massive amount of management information, it puts it into a form that aids decision-making instead of merely producing more reports.

This type of decision-oriented approach is being applied in every area of the production plants of IBM. Changes resulting from the new approach have necessitated certain adjustments on the part of personnel. An interesting example. was revealed when the purchasing agents became quite distressed because the job of signing certain purchase orders was turned over to the computer. When they finally adjusted to the situation, however, they found that with such routine matters out of their hands, they were able to devote their time and effort to the more important and larger dollar expenditures.[4]

Further personnel problems have arisen as a result of the faster reporting techniques that provide information so fast that the company president knows of a plant breakdown or emergency as soon as the manager does. This type of situation makes it possible for the top brass to know all and see all, thereby placing managers and mid-level executives in difficult predicaments at times. These problems must be met squarely. New ideas and attitudes must be adopted to coincide with the changing conditions resulting from the total system approach. In most instances the transition will be swift,without major incident, as management finds the advantages realized far overshadow the problems encountered..

SIMULATION

The development of planning through the study of alternatives, called simulation, has been one of the dynamic concepts bestowed upon business by computer technology. Using one minute of computer time, the operation of an entire business for a period of 400 weeks may be simulated.[5]

Simulation, or the mathematical representation of a system in order to see how change in one of its elements will affect the others, is one of the most promising aspects of business electronic data processing. It has become particularly useful in the area of production, less so in financial matters, except as used in research and teaching aids. However, the feasibility of its use in financial matters has been brought under investigation in recent months. A study by the Burroughs Corporation, experimenting with a simulation of the entire financial structure of the company has indicated conclusively that the simulation technique can provide management with an effective new planning tool. The Burroughs people found that simulation was particularly useful in the area of financial planning because of its ability to be applied to problems that are too complex and have too many variables to be reduced to optimization formulas.[6] It has proven to be the only means with which to cope with the complexity of the financial planning process in the level of detail deemed essential, while at the same time, retaining the inherent flexibility needed to accommodate change.

Stated simply, simulation involves the input of a description of a company's operations into the computer, which in turn, produces several alternatives for decisions concerning product-flow, manpower, etc. It is then up to management to choose the best alternatives, rather than gambling on the old "trial and error" method. By relying on facts rather than guesswork or intuition, many mistakes will be avoided and much time, effort, and profit saved. In recent applications, some oil companies have had significant success employing simulation relating to the selection of new station sites.

A financial simulation model such as that used in the Burrough's study, mentioned earlier, may aptly be defined as a formal statement of the relationships among the elements of a company's financial structure. If the model is to be an effective planning tool, it must explicitly reflect cause and effect both within the specific business process and between the business and the market in which it participates. The model must describe specifically the form in which marketing demands are translated into production requirements, both as a direct functional relationship and in terms of the time transformation represented in this relationship.

Construction of a model is an expensive and time-consuming process requiring the cooperation of all echelons of management in the organization. This cooperation and participation is not only imperative to the development of the model, it further provides the executives involved with knowledge concerning the nature and use of the approach. They will understand how the model works, how to use it to simulate various policies and plans, and how to interpret its output. This understanding on the part of managers will add realism to the model and provide the impetus for its acceptance as an official corporate planning tool.

Another major contribution resulting from the use of simulation is that of inventory control. The control of inventories has long been a problem of management and one that reaches out to affect the economy as a whole. Through the adaptation of simulation, the problem of inventory control has been minimized. By helping to solve this problem, the use of computer simulation has indirectly helped manufacturers to offer better service with fewer risks and at no increase in cost. At present, relatively few companies are using these advanced inventory systems. Their use is becoming more widely spread, however, and within the next ten years it seems apparent that most major corporations will be utilizing computers in inventory control.

OPERATIONS RESEARCH

The concept of operations research (OR) is best defined as the "systematic, method-oriented study of the basic structure, characteristics, functions and relationships of an organization."[7] Operations research is formulated on the concept that an economic system is based upon an orderliness similar to the physical world. Some of the goals of OR include:

1. Determining how a system behaves under a wide range of conditions,
2. Determining the relationships which explain why the system behaves in this manner, and
3. Discovering the manner in which this behavior should be changed in order to optimize the company's goals.

OR borrows many of its techniques from such fields as statistics, mathematics, symbolic logic, physics, and psychology. Its effectiveness has been greatly enhanced in recent years by the development of electronic computers. Although in some instances studies may be conducted with little or no use of computer time, most types of study, previously beyond the time limits of any feasible number of people, may now be handled on the computer in record time. Without the availability of electronic computers, most significant operations research studies would be impossible.

One area in which OR has achieved significant success is that of solving "executive type" problems. This designation describes those problems of top management involving conflicts of interest among various divisions or departments within an organization. In dealing with such conflicts of interest, management must follow a course which will lead to maximum effectiveness of the organization as a whole. OR has provided the degree of objectivity required in this type of decision-making.

It is interesting to note that the development of operations research began in England in 1939 by a group of scientists assigned to military operations. The interaction among this group, which included physicists, engineers, mathematicians, psychologists, etc. resulted in some outstanding contributions to the war effort, including the effective use of radar, allocation of planes to missions, and pattern determination for use in submarine searches.[8] It was after World War II that the methods and techniques applied by the military were adapted to business usage. Operations research matured quite slowly, but with the advent of the computer, OR burst into full bloom. In fact, the development of operations research is closely connected with the evolution of computers for commercial application. Rapid and accurate handling of vast quantities of data relating to a large number of inter-related variables, combined with automatic selection from alternatives according to a predetermined pattern, is both the outstanding characteristic of a computer and a prerequisite to the application of the mathematical techniques referred to.

In brief, the steps involved in operations research may be outlined as follows:

1. Analysis of the system. Before a new system may be intelligently formulated, the existing system must be thoroughly understood. The disadvantages of the existing system must be noted as well as an appraisal of what the new system must provide in order to justify the changeover. This portion of the approach is commonly referred to as an orientation feasibility study.

2. Construction of a model. The formal model is usually a mathematical representation of the system under study. It must bear sufficient likeness to the real situation so that it may be manipulated meaningfully.

3. Testing the model. Only those real conditions that are pertinent to the problem solution may be reflected in the model. Analysis of this pertinent data will then lead to necessary changes and refinement of the model.

4. Solving the problem. The process of solving the model means that for any given condition or conditions within stated policies and limitations, the model is used to establish recommended courses of action.

5. Controlling the model and solution. It is necessary to establish controls to gauge the limits of reliability of the model and its solution and further to determine what possible future modifications may be required of either model or solution.

6. Implementing results. The final step involves putting the findings of prior research to work.

There appears to be no limit to the types of business and industries which may profit generously through the use of operations research. It has been used extensively in the petroleum, chemical, metal processing, aircraft, rubber, mining, and textile industries, to name only a few.[9] It has been used successfully in solving executive problems in the areas of production, marketing and distribution, investment and finance, organization, credit analysis, etc.

Operations research is not without its problems and pitfalls. Results may range from complete to very limited success. This broad range of possibility causes management to have certain reservations concerning OR. It is well to consider a few of the common pitfalls, some obvious and others quite subtle, which have on occasion prevented optimum success in the application of operations research.

Oddly enough, the success of OR may be doomed before the study is off the ground. That is, the most difficult and important phase of the entire study is that of problem formulation. Many questions must be asked before this phase may be completed. Is the right problem being solved? Is it being considered in its proper scope? Are appropriate measures of performance being used? Success in the problem formulation stage does not insure complete final success, but failure of this phase will surely minimize the achievement of significant goals.

Other dangers lie in problem solving. Sometimes an organization may place too much emphasis on achieving an elaborate and sophisticated answer, which, due to the greater time involved, may arrive too late or be too complex to be used. A less complicated and complex solution, arrived at in less time and at less expense, will normally yield a larger profit.

Although computers have resulted in making operations research practical, their misuse has often led to an unsuccessful OR study. By becoming too engrossed with problem solving techniques, some OR teams have employed the high-speed computer capabilities to solve with great swiftness and dexterity a problem that was not properly defined. This appears to be the inevitable result of their eagerness to utilize their new and glamorous tool, the computer.

It has also been pointed out by the experts that a good OR research study may raise more questions than it answers. At first thought, this characteristic may seem to indicate a weakness; however, it is seen by many to represent one of the strongest attributes of operations research. By raising more questions, the OR study will ultimately lead management to the solution of problems still unseen and benefits and achievements not yet contemplated.

ON LINE-REAL TIME SYSTEMS

In a total on line-real time (OLRT) system, each person and every machine or point of origin in the organization that must originate, retrieve, or utilize information is provided with a point-of-origin device (POD). These devices are connected to a central processing device by some means of direct communication link. These devices allow two-directional information flows at a point of origin so that every person or machine using it receives responses in the amount of time required. In a system of this nature, all information for every person from clerk to company president is inserted and is available through the point of origin devices.

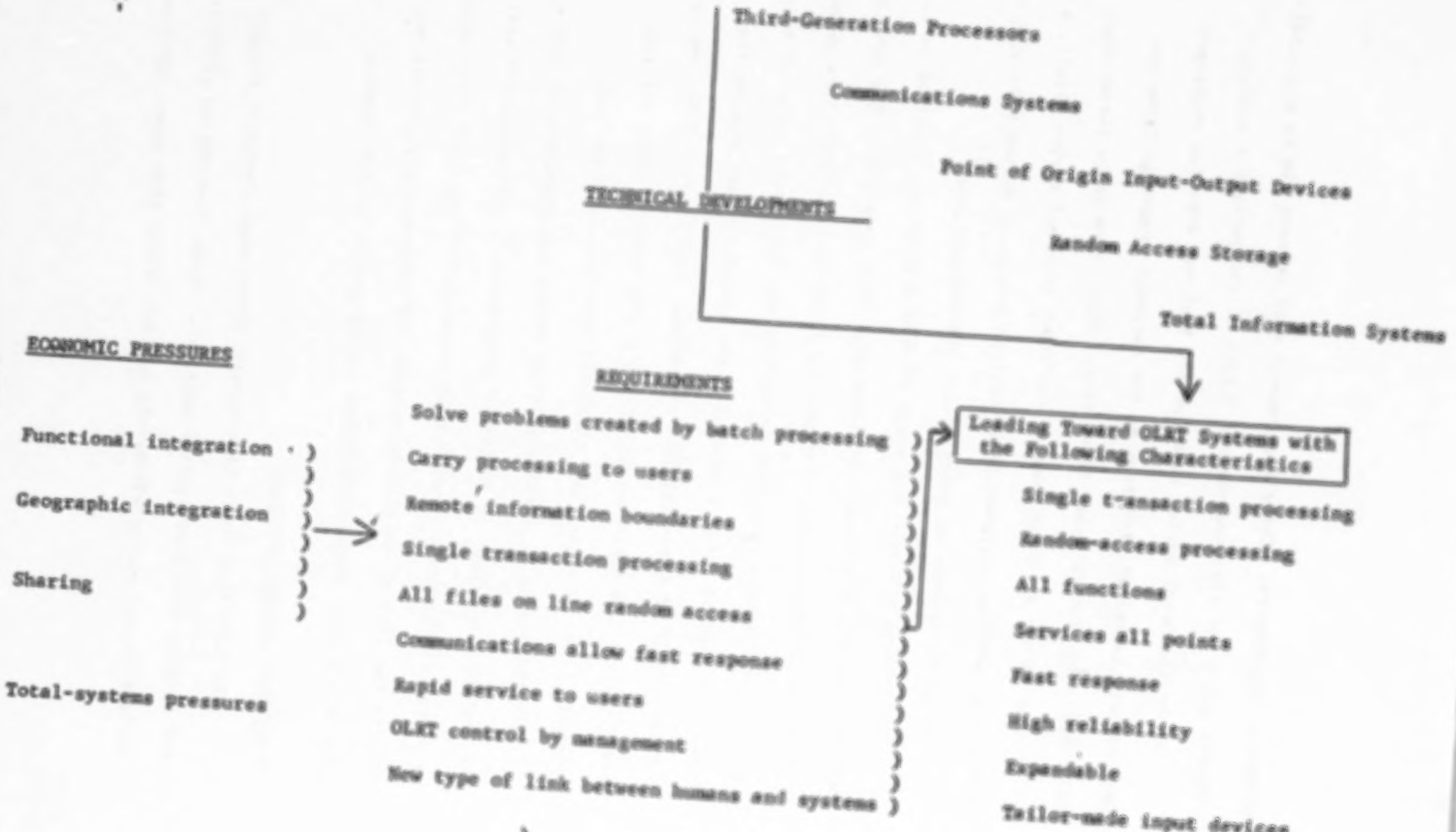
The concept of the OLRT system, as opposed to the "batch methods of data processing" is gaining more supporters. In the past it has been the general contention that the high cost prohibited all organizations outside of airlines or some financial institutions from utilizing OLRT. The "new look" is to consider OLRT as a potential long range goal for the entire corporate business system. The diagram on the following page illustrates how fundamental economic and total-systems pressures lead to a set of requirements which may now be met through modern technical developments to form systems of an OLRT nature.

It is interesting to note some of the organizations who have decided to try the "new look." Although insurance companies could be listed as pioneers in the utilization of EDP, they did not take an active interest in OLRT until 1962. As of 1964, such well-known companies as Allstate, Travelers, Equitable, and Metropolitan had announced OLRT plans.[10]

As mentioned earlier, nearly every large airline has a system installed. The major lines are moving in the direction of OLRT mechanization of related functions in the operations and accounting areas.

Federal, state, and local government agencies have been active in the use of OLRT systems. California and New York have led the list utilizing the systems in their state employment divisions, welfare departments, and criminal intelligence sections.[11]

An interesting usage of the OLRT system is being utilized at the Children's Hospital in Akron, Ohio. Not only are patient services, accounting, and accounts receivables included in the system, but the patient himself will be connected to the system through the use of


TECHNICAL DEVELOPMENTS
Third-Generation Processors
Communications Systems
Point of Origin Input-Output Devices
Random Access Storage
Total Information Systems
ECONOMIC PRESSURES
Functional integration
Geographic integration
Sharing
Total-systems pressures
REQUIREMENTS
Solve problems created by batch processing
Carry processing to users
Remote information boundaries
Single transaction processing
All files on line random access
Communications allow fast response
Rapid service to users
OLRT control by management
New type of link between humans and systems
Leading Toward OLRT Systems with the Following Characteristics
Single transaction processing
Random-access processing
All functions
Services all points
Fast response
High reliability
Expandable
Tailor-made input devices

OLRT DIAGRAM[12]

measuring instruments. These instruments will connect him to a central computer which notifies doctors and nurses of the patient's condition.[13]

In the financial world, both the New York and American exchanges have systems installed, and some of the national brokerage firms are also utilizing certain types of systems. There seem to be three types of systems in use in these areas: the stock exchange system itself, a system for handling customer accounts, and a type of system providing information to brokers on stock prices and transactions.[14]

The growing interest and usage of OLRT systems has resulted in large measure from the development of lower cost OLRT computers. The new IBM System/360 is specifically designed for total On Line-Real Time systems. An array of hardware including communications equipment, point of origin terminal equipment, etc. accompanied the system and has brought the possibility of On Line-Real Time operations into focus. Other new developments include the introduction of RCA's 3488 memory, which utilizes magnetic cards at a cost per character less than magnetic tape.

At this point, a serious problem facing the expansion of OLRT systems is that of a shortage of qualified programers.[15] Education and training efforts will ultimately solve this manpower shortage, but until this occurs the lack of sufficient systems and programming personnel may be one of the most serious obstacles to the growth of OLRT systems.

NUMERICAL CONTROL MACHINES

The past five years have brought about some startling changes in the area of numerical control machines. These fascinating production tools that are run by electronic control rather than human hands have been a major challenge to electronics firms who have sought to bring their cost down to a realistic level. Formerly ranging in price from $100,000 to $500,000, the new scaled down models are now running as low as double that of conventional ones.[16] This is not to imply that current prices are cheap, but from a production standpoint, a machine with the capacity to handle three to four times the work is well worth twice the price.

Not only have price ranges dropped to more realistic levels, but many of the old technical problems have been solved. Programming has been simplified,and some companies have been able to train their present shop employees to handle simple jobs. Outside numerical control services are also flourishing, and these have supplied the answer for many firms.

As the situation now stands, less than 1% of the machine tools in use in the United States are numerically controlled. However, half of these machines were installed only last year, and industrial experts predict that by 1970 two-thirds of the money spent on machine tools will go for numerically controlled systems.[17] This money will go to purchase two basic types of machines -- point-to-point and contouring. The point-to-point, or positioning, system, is simpler in that it involves merely guiding a cutting tool to specific locations on the work surface. The contouring system must do a more technical and intricate job. It must not only direct the proper starting point, cutting speed, and depth, but in some instances must guide the tool along shapes that cannot be exactly defined by mathematical equations and are affected by the wearing down of the cutting tool itself.

What about the savings of time and money involved in the use of numerically controlled machines? TRW Electronics found that a booster-pump flange produced with an NC unit was 96.3% cheaper than when produced conventionally![18] Savings like this can only be realized by companies with enough skilled manpower and large-scale production to keep their NC machines running 80% of the time. A $100,000 machine must work very long hours to pay for itself.

One further development has been the installation of electronic and servomechanisms on existing manually operated machines to adapt them to numerical control. This innovation, called retrofitting, should provide an additional impetus to the movement.

The future applications of EDP in business appear almost without end, and those discussed briefly in this paper represent only a very small segment of the whole. New adaptations are being developed so rapidly that it is difficult even for those dynamically involved in the field to keep abreast of its growth. It is a fascinating and fast-moving field that can certainly be said to have revolutionized not only the business community but the entire economic structure of our society. Its future potential staggers the imagination and in fact is limited only by the imagination of man.

FOOTNOTES

[1] Wayne S. Boutell, *Auditing With The Computer* (Los Angeles: University of California Press, 1965), p. 3.

[2] A. F. Maravec, "Basic Concepts for Designing a Fundamental Information System," *Management Services*, July-August, 1965, p. 38.

[3] Henry De Vos (ed.), *Management Services Handbook* (New York: American Institute of CPAS, Inc., 1964), p. 290.

[4] Herbert E. Klein, "Information Explosion in the Factory," *Dun's Review*, March, 1965, p. 244.

[5] Gilbert Burck, "The Boundless Age of the Computer," *Fortune Magazine*, March, 1964, p. 109.

[6] E. N. Khoury and Wayne Nelson, "Simulation in Financial Planning," *Management Services*, March-April, 1965, p. 14.

[7] E. Leonard Arnoff and M. J. Netzorg, "Operations Research -- The Basics," *Management Services*, January-February, 1965, p. 42.

[8] Arnoff and Netzorg, p. 45.

[9] Arnoff and Netzorg, p. 46.

[10] Richard E. Sprague, "On Line-Real Time Systems -- 1964," *Management Services*, May-June, 1964, p. 42.

[11] Sprague, p. 44.

[12] Sprague, p. 42.

[13] Sprague, p. 45.

[14] Sprague, p. 45.

[15] Sprague, p. 49.

[16] Herbert E. Klein, "Numerical Control: From Class to-Mass Market," *Dun's Review*, August, 1965, p. 35.

[17] Klein, p. 63.

[18] Klein, p. 64.

BIBLIOGRAPHY

BOOKS

Boutell, Wayne S. *Auditing With The Computer*. Los Angeles: University of California Press, 1965.

Chapin, Ned. *An Introduction to Automatic Computers*. Princeton: D. Van Nostrand Company, Inc., 1963.

De Vos, Henry (ed.). *Management Services Handbook*. New York: American Institute of CPAS, Inc., 1964.

Heckert, J. Brooks, and Wilson, James D. *Controllership*. New York: The Ronald Press Company, 1963.

McCracken, Daniel, Weiss, Harold, and Lee, Tsai-hwa. *Programming Business Computers*. New York: John Wiley & Sons, Inc., 1965.

Meigs, Walter B. *Principles of Auditing.* Homewood: Richard D. Irwin, Inc., 1964.

Murphy, Mary E. *Managerial Accounting.* Princeton: D. Van Nostrand Company, Inc., 1963.

PERIODICALS

Arnoff, E. Leonard, and Netzorg, M. J. "Operations Research -- The Basics," *Management Services*, January-February, 1965.

Burck, Gilbert. "The Boundless Age of the Computers," *Fortune Magazine*, March, 1964.

Khoury, E. N. and Nelson, Wayne. "Simulation in Financial Planning," *Management Services*, March-April, 1965.

Klein, Herbert E. "Information Explosion in the Factory," *Dun's Review*, March, 1965.

Klein, Herbert E. "Numerical Control: From Class to Mass Market," *Dun's Review*, August, 1965.

Maravec, A. F. "Basic Concepts for Designing a Fundamental Information System," *Management Services*, July-August, 1965.

Sprague, Richard E. "On Line-Real Time Systems," Management Services, May-June, 1964.

SCIENTIFIC APPLICATIONS OF DATA PROCESSING

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August 7, 1965

SCIENTIFIC APPLICATIONS OF DATA PROCESSING

Statement of the Problem:

The purpose of this paper is to show by examples how data processing is being utilized in some of the various branches of modern science.

CONTENTS

I. Introduction

II. Astronomy

III. Biology

IV. Chemistry

V. Earth Science

VI. Mathematics

VII. Meteorology

VIII. Medicine

IX. Physics

X. Conclusions

I. Introduction

Since man first learned to count he has been attempting to evade the drudgery of the computations evolving from those ideas of his which are susceptible to being reduced to numbers or are based upon numerical data. In many instances the sheer weight of the computations involved has caused abandonment or avoidance of problems which would otherwise have been pursued.

With the development of the electronic data processing machine, man at last seems to have a tool which will permit his mind and imagination to range at will without restriction from his personal ability to carry out the calculations which might be involved.

Although real progress in the development of fast computing machines only began during World War II to meet such requirements as the preparation of huge numbers of artillery firing tables, business was quick to recognize their value and put them to such widespread use that today many schools and colleges look upon data processing machines from a business-oriented point of view only, while the interest of science and mathematics are often overlooked. It would be well if the applications of data processing in these fields are occasionally reviewed.

II. Astronomy

The word astronomy alone evokes the image of large numbers, and with large numbers, involved calculations. Dr. Robert F. Christy of the California Institute of Technology in a study of two stars, Cepheids and RR Lyrae, which seem to brighten and dim regularly, studied "copies" of these stars in a computer using calculations based on numerical solutions of Newton's equations of motion and heat flow. These calculations were originally obtained from experiments carried out at the Los Alamos Scientific Laboratories. At that time one calculation took two weeks to perform. Now the computers solve even more difficult problems in minutes. According to his calculations, the source of the pulsations, changes in brightness and other properties is heat from the core of the stars arising from nuclear reaction.[1] Without the aid of computers it is doubtful that the results of such a study would be available for months or even years.

III. Biology

One does not usually look upon biology as a scientific field requiring the use of formulas and computation except perhaps in such narrow fields as genetics. However, two examples will serve to show how biology can also make use of the computer.

Certain types of soil will encourage the growth of certain types of plants. An ecologist will walk over an area, make observations, and, drawing from past experience, reach certain conclusions. In 1963 W. T. Williams, an Englishman, posed the question of whether or not it would be possible to extract from a mass of complex data an underlying principle or patters using a computer. He provided the computer with information concerning a series of small samples of soil taken in an area arranged in a grid with names of plants from each grid being given a numerical code. He hoped that the computer would delineate patches of ground which had been set afire by sparks from passing trains. The computer gave these burnt patches only minor significance, dividing the area instead into two basic areas. Further investigation showed that this line defined a soil difference, a boundary between Barton Sand and Plateau Gravel, which was not obvious from surface observations.

In another study by Mr. Williams of grazing areas, the computer ignored the obvious and drew a line which coincided with the parish boundary. An investigation of historical records showed that in 1840 one parish had drained its land and the other had not. The difference after over a century was still detectable in distinct types of vegetation.[2]

The rate of plant growth is based on a number of factors, including such things as temperature, amount of moisture, length of day and light intensity. By analyzing these factors, physiologists of the U. S. Department of Agriculture produced mathematical formulas which they believed could predict the rate of plant growth. The formulas are based on the relationship between leaf development and a given environmental factor. By using electronic computers to analyze data on plant growth response and environmental factors, the scientist determined the probable amount of influence each factor had on the crop each day. Thousands of computations were needed, but the accuracy of the statistical results agreed "to a startling degree" with the actual test results.[3]

IV. Chemistry

Any student who has had even a basic college course in chemistry knows that this is a branch of science which involves computations. At the research level computation takes on even more significance. In principle all chemical phenomena can be deduced from the laws of quantum physics, but in practice most are too difficult to be solved by straightforward application of physical equations. An extreme example of this was an experiment carried out by Don L. Bunker at the Los Alamos Scientific Laboratory. The scientist and his colleagues, using a computer, proposed a problem involving hypothetical reactions. The solution of their problem required the solving of the Newtonian equation of motion 150 million times.[4]

V. Earth Science

When Charles Darwin made his famous voyage in the "Beagle" he collected specimens, made observations and kept detailed notes in his diary. Upon his return he spent years studying and classifying in order to bring some sort of order to his findings. By contrast, the research vessel "Atlantis II," operated by the Woods Hole Oceanographic Institution of Woods Hole, Massachussetts, carries twenty-eight scientists and a computer. The purpose of the voyage is to chart the ocean currents, take a census of marine life and probe the ocean floor. The Indian Ocean phase is part of a UNESCO experiment to help Middle East nations increase their food supply by using the resources of the Indian Ocean. As exact locations are necessary, the computer not only collects oceanographic data, but also helps navigate the ship using a new navigational system that makes use of signals from orbiting earth satellites. When not busy navigating the ship, the computer is busy juggling data on salinity, water temperature and ocean currents. The computer makes it possible for many types of readings to be taken continuously, and gives immediate answers to questions relating to the data.[5]

VI. Mathematics

There are some who do not like to include mathematics in the sciences, but it is such a necessary tool that it has been referred to as the Queen of Science. If such a description be accepted, then any general review of science must certainly look at mathematics.

Inasmuch as mathematics involves logic as well as computation, there are some phases which do not lend themselves too easily to computer usage. These problems are ones that "seem to require the agent of human intelligence and ingenuity for their solution."[6] With this in mind, the IBM Research Center in New York has set up a long-range program directed at the problem of learning in machines. A theorem-proving geometry machine has been developed which is able to prove many relatively simple theorems such as "a point on the bisector of an angle is equidistant from the sides of the angle" in less than a minute. The object in the development of this machine is not to design a machine capable of proving theorems in Euclidian plane geometry, but to serve as a framework within which other explorations may be pursued.[7]

There are, however, many applications in which the computer can aid the mathematician, particularly in the solution of formula-type problems. A somewhat useless example is that in which an ENIAC calaulating machine in about 70 hours computed pi to 2035 decimal places, a feat that by hand might take all of a normal lifetime of hard labor.[8]

VII. Meteorology

The science of meteorology can use the computer to greater advantage than almost any other science, if for no other reasons than the vast amount of continually changing data and the limited amount of time to work with it.

Less than thirty years ago the weather observer made his periodic observations of the clouds, wind, temperature, humidity and rainfall, coded them, and transmitted the coded information at the proper time to other stations. In turn he received similar observations from other stations, carefully transcribed them onto his map, and drew in the isobars. Using his experience with past maps which had similar configurations, and with an occasional glance out the window, he then made his forecast. Oddly enough he was right most of the time, although the public tended to remember only the times when he was wrong. Then the Norwegians advanced their theory of air-mass analysis and meteorology was a full-grown branch of science. Unfortunately by the time the air masses were analyzed, the local weather had passed. The atmosphere, though subject to the laws of physics, was much too complicated to be handled in the time available. More stations and orbiting satellites only added to the problem, creating more data to be added to that which could not be used except for study and research.

With the computer all this has changed. Accurate long-range forecast of floods, droughts, hurricanes and areas of severe local storms are dependable. But there has been little improvement in local forecasting because of local conditions such as lakes, hills, mountains, bays, forests and oceans. When the use of computers becomes so general that local features can be included in the stored data, farmers can cut their hay, shoe stores can run large advertisement for their sales, and the general public can leave their raincoats at home, confident that the prediction of fair weather will be accurate.

VIII. Medicine

In the field of medicine, computers have been used chiefly in the statistical field and as a tool for information retrieval. A number of hospitals are placing data pertaining to patients on records which by use of a computer can be immediately available to doctors. With such a tool available, many doctors have begun to experiment with the idea of having the computer aid in diagonosis. A newspaper article in the "Miami Herald," July 24, 1965, quoted Dr. W. D. Snively, Vice-President for Medical Affairs of the Mead Johnson Company as saying the computer has great potential "for the systematic sorting and assembling of observations, and for deductions concerning what these observations mean..." Dr. Snively, a specialist in body fluid imbalance, has worked out an inventory of symptoms, conditions, all known factors, and the possible disorders that might exist from imbalances, gave each a coded numerical value based on known normal conditions in fluid balance and which disorders are most likely to occur. All the diagnostic clues are then punched into an IBM card using the code numerals assigned to each condition, and the computer immediately comes up with a probable diagnosis and a possible diagnosis. Dr. Snively emphasized the fact that the computer findings are not necessarily correct as there are many factors not possible to feed into the computer, factors that depend on the physician's judgement. It does, however, have the virtue of eliminating practically everything which could not possibly be the trouble.

In the field of psychiatry, case histories play an important part, but these are seldom of value beyond the single institution where they are compiled. Researchers are confronted with delays and inadequacies in obtaining case material which would aid in their work. To assist in such work, Dr. Bernice T. Eidson, research director for the Reiss-Davis Clinic for Child Guidance of Los Angeles, has begun a two-year study in which hospitals and clinics will collect large amounts of recent data and by means of an event method of punch card processing will provide researchers with complete sets of pertinent information easily and quickly. Material will be made available for large-scale research into mental illnesses as well as for local application and patient treatment and administration.[9]

Although it is unlikely that the time will arrive when it will only be necessary for a patient to feed his symptoms into a computer and receive a prescription in return, it is very likely that the computer will soon be accepted as a normal weapon in the fight against man's ills.

IX. Physics

Physics is one of the sciences most susceptable to quantitative analysis. By observation and the application of mathematical deductive reasoning, physicists have pushed back the boundaries of the unknown until it appears that there may be no limits to the inquiring mind. The computer is only speeding up the process.

It has been only a few years since the "smashing" of the atom made headlines, but already it has changed the world. The time element involved in such experiments is such that most of what occurs is deduced from the results. Columbia University has reported using its atom smasher with the devices for detecting atomic reastions linked to the computer. Whereas scientists had previously attempted to make their observations and given the word to photograph them, the computer is now used to scan the atomic debris resulting when nuclear particles collide in the accelerator. The speed of the computer is such that it can automatically modify the exposure conditions to improve the photographs, and use the time between collisions to analyze the results of previous bursts. The results are considerably more accurate than physicists earning their Ph.D. degrees have been able to achieve in the last twenty years.[10]

X. Conclusions

There can be little doubt that the computer has become as indispensable a part of the scientist as the slide-rule was once a part of the engineer, a tool not looked upon as a luxury but a necessity. Just as the steam engine freed mankind from much of his physical labors and permitted him to multiply the effort of his muscles manyfold, so will the computer free his mind to probe and ponder, then move on quickly to more distant and complex challenges. People will applaud and accept the benefits from each new conquest with little realization that behind most of them will sit a computer with its fascinating array of blinking lights, and behind each computer will be a programmer who is also a scientist, or a scientist who is also a programmer.

REFERENCES

[1] "Computers Show How Real Stars Behave," Science News Letter, ed. Watson Davis (May 2, 1964), p. 280.

[2] W. T. Wilson, "The Computer As A Botonist," Saturday Review (June 1, 1963), pp. 44-45.

[3] "Computers Now Foretell How Fast Plants Will Grow," Science News Letter, ed. Watson Davis (September 14, 1963), p. 168.

[4] Don L. Bunker, "Computer Experiments in Chemistry," Scientific American (July 1964), p. 101.

[5] "Seagoing Computer," Science Digest, ed. Hubert Pryor (May 1965), pp. 24-25.

[6] H. Gelernter, "Realization of A Geometry-Theorem Proving Machine," Computers and Thought, ed. Edward A. Feigenbaum and Julian Feldman, McGraw-Hill Book Company, Inc., New York, 1963, p. 134.

[7] ibid, p. 147.

[8] Eric Temple Bell, "The Queen of Mathematics," The World of Mathematics, Vol. I, Simon Schuster, New York, 1956, p. 514.

[9] "Computers Aid Doctors," Science News Letter, ed. Watson Davis (May 30, 1964), p. 342.

[10] "Computer System Mixes Science, Business Task," Science News Letter, ed. Watson Davis (April 17, 1965), p. 247.

INDUSTRIAL APPLICATIONS OF DATA PROCESSING

Robert F. Martin

August 6, 1965

INDUSTRIAL APPLICATIONS OF DATA PROCESSING

Statement of the Problem:

A discussion of new concepts in industrial management must cover various aspects of the jobs of planning, organizing, directing, co-ordinating, and controlling in different areas of industrial operations. Industrial operations will be defined as manufacturing production or operations applications concerned with day-to-day production of a user's primary production or service. In this paper, information will be presented to inform the reader of some of the many applications of data processing as it serves management in the accomplishment of the above functions.

The writer makes no pretense of an exhaustive list of applications or processes and will attempt to exclude the commercial and scientific applications that often seem to be inherent in an industrial application. It is for this reason that a seeming duplication of processes might be noted in this discussion, but this is inevitable because many industries quite often find it to be efficient to employ a combination of processes within the same system.

Informational outline form will be used for the sake of brevity and for ready referencing. The references will be from the viewpoint of the processes involved rather than by industries.

APPLIED PROCESSES

I. Numerical Control

Numerical control allows management to plan processes and to control operations exclusively with the quantitative measurements rather than qualitative ones. A numerical control production machine can be defined as an electro-mechanical system having controls that guide a tool capable of performing a phase of a fabricating process. The tool must be told exactly where to move and what to do. The direction in which the tool moves, velocities and feeds, type of operation, together with auxiliary machine commands are directed by digital input data such as paper tape, magnetic tape, or punched cards. There is no human intervention during the operation of the programmed functions that are activating the machine. This process finds its most versatility in the metal working industry.

II. Linear Programming

Many oil refineries utilize linear programming which is a mathematical, analytical method of determining the optimal solution to a problem which is affected by a large number of variables. For example, how does a refinery settle best plant operation, perfect the optimal blend of gasoline stock, or best transport the crude oil? A computer system runs an 85,000 barrel a day refinery in Tulsa, Oklahoma. The computer gets information from 191 process instruments continuously and checks their recordings against programmed engineer limits set into memory. If there are variances the computer calculates the corrections and sends them to activate appropriate valves and switches.

A leading meat packing company has found great savings in utilizing linear programming to find the optimal blend for the marketing of their sausage. This data processing theory also, finds great utility in the transportation industry in computing advantageous routes.

III. Real Time

Real time is a mode of operation in which data necessary to the control and/or execution of a transaction can be processed in time for the transaction to be affected by the results of the processing. Real time processing is most usually identified with great speed but speed is relative. The other important characteristics are concurrency and simultaneity. Applications - steel producing firms, smelting operations, and most operations where time and control are needed. For example, tons of steel go through rolling mills at 35 miles per hour with only one human operator in charge. Here again we find oil refineries utilizing this process.

IV. Computer Process Control

The purely business computer has advanced from merely automatic accounting to the control of inventory and production scheduling. On the process side, it has moved from monitoring the automatic balancing of process variables - as a by-product it provides data about the process that can be used. Power, petroleum, and chemical industries pioneered the shift to computer process control, with the biggest advancement coming in steel - with plant expansion, basic oxygen furnaces, continuous casting, all utilizing computer process control. Says one maker of process computers, "We're no longer involved in missionary work where we had to spend a lot of time on feasibility studies. Now the computer is the first thing definite about the design of a new plant."

In 1965, it is expected that 100 to 125 more process control computers will be added to the 300 already installed. Some predict that there will be 4,000 installations by 1970.

V. Type setting systems

One of the more unusual applications is the electronic compensation or justification of raw newscopy to conform with newspaper column width for automatic typesetting. A reporter's edited copy can be fed into a computer that has type set, which then combines it in page form with pictures and flashes a complete page on a cathode ray tube for conversion through new engraving methods into a plate for the printing press - all in less than ten minutes.

VI. Information networks - Teleprocessing

Data communications networks are knitting together company branches and headquarter computers, just as process control hook-ups are tying in manufacturing operations. This year there will be a mojor spurt in the transmission of business data by telephone lines. Western Union expects to have a half dozen major companies sending business data between branches and central computers over 7,500 miles of micrwave network and by what is known as broadband exchange service built special for computer-to-computer talk. It is these networks that will make it possible to operate big central computers more economically, through time-sharing. One manufacturer has a service that now enables forty technicians to use the computer almost simultaneously via telephone. Only about 2 per cent of medium and large-scale systems now in use have teleprocessing connections.

VII. Control Data (Trade mark)

Making original and far reaching advances in the digital computer industry, Control Data Corporation has grown from less than a dozen employees to nearly 10,000 in only eight years. In this short period of time it has placed on the market a complete line of advanced digital computers and peripheral equipment. Even though this report has attempted to avoid trade-mark processes, the organizational outline for manufacturing industrial computer equipment of this particular corporation is included for it offers an insight into many industrial applications.

A. Industrial Data Processing Division

Design, development and manufacture of message and data switching systems, record transmission systems, data collection systems, and on-line inquiry systems.

B. Engineering Division

This division specializes in the manufacture of high-precision, electro-mechanical devices. Areas of responsibility include the design, development and manufacture of servo components and digital components.

C. Control Corporation

Supervisory, telemetering and associated data logging for oil and gas transmission and distribution, power distribution, and industrial control systems for automotive, sewage and water, cement, transportation, mining and medical clinical testing and monitoring systems. The scope also includes the general area of quality control and production testing.

D. Control Systems Division

Industrial control systems, which includes digital computers, associated special input/output equipment, digital data acquisition, analog conversion equipment, which are or may be expanded to closed loop control of a manufacturing process in the chemical, petro-chemical, food, steel and metals, power and nuclear, oil and gas production and other continuous or semi-continuous process industries.

E. Datatrol

The professional programming and systems capabilities of Datatrol are applied to a broad range of applications. Typical applications include management information systems, as well as information control and data collection systems. Datatrol's analytical skills are applied to assist customers in defining their problems, and preparing the specialized computer software that results in problem solutions. Datatrol also explores new application areas to which computers can be applied to the solution of customer problems.

F. Research Division

Several current projects are being conducted in space navigation, semi-conductor and thin film techniques, magnetic devices, information theory, and integrated circuits.

G. TRG Incorporated

TRG explores the possibility that Lasers will be used in computers for displays, memories, character recognition, and for data transmission for joint corporate purposes. TRG is also engaged in sensor and radar developments requiring computers for military and civilian air traffic control, communications and proximity warning applications. TRG has also been active in the training and simulation field.

CONCLUSION

The computer got its foothold in industry by way of the laboratory and accounting office. More recently it has come through monitoring processes and achieved the ability to sound a warning when something needs adjusting; but by the end of this year, 1965, the computer will be coming close to its ultimate goal - centralized control of all stages of production. Quoting from Mr. Fridlin's lecture, "There is nothing a computer can't do if you are willing to pay for it!"

BIBLIOGRAPHY

1. Top Management and Computer Profits, J. T. Garrity, HARVARD BUSINESS REVIEW, Vol. 41, page 6-8, July, 1963.

2. Spark of The Second Industrial Revolution, A. C. Clarke, NEW YORK TIMES MAGAZINE, page 32, December 9, 1962.

3. Tomorrow's Plant Now; Western Electric's Kansas City Plant, BUSINESS WEEK, page 52-53, August 1, 1964.

4. Robot in the Workshop, Computer Process Control, il. DUNS REVIEW, Vol. 79:88,90, March, 1962.

5. Automation Takes Hold in Printing Industry, il. BUSINESS WEEK, page 56-58, January 19, 1963.

6. Information Networks - Teleprocessing, BUSINESS WEEK, January 2, 1965.

7. You Are the Difference, CONTROL DATA CORPORATION, December 20, 1963, President's Newsletter.

Numerous pamphlets and brochures from the manufacturers of data processing equipment were used in compiling this report.

EDUCATIONAL APPLICATIONS OF DATA PROCESSING

Curtis J. Kinney

July 28, 1965

EDUCATIONAL APPLICATIONS OF DATA PROCESSING

Statement of the Problem:

For many years demands on the teacher's time have been greatly increasing. Class sizes have been pushed to the maximum. The use of data processing equipment for many clerical tasks presently handled by professional school personnel will be one of the major changes over the next decade in the public and private schools. By September, 1964, about 800 data processing systems were in operation in the school systems throughout the country, and the number is increasing rapidly. Data processing in the schools has contributed to the rational desire to release teachers and administrators from clerical responsibilities that take valuable professional time that could be more profitably used on more important educational activities. Not only can the use of electronic data processing equipment recoup much lost teaching time, but the school personnel can have access to more data faster than previously possible.

There have been long and frequent discussions concerning the teaching of data processing in the public schools. Discussion has taken place on such topics as: (1) Should EDP be taught? (2) At what grade level should EDP be taught? (3) How much EDP should be taught? (4) Is EDP equipment too expensive for the school budget? In the November, 1964, issue of the AEDS BULLETIN, G. Ernest Anderson, Jr. stated: "No pupil should graduate from high school without some idea of the roles automation and information processing are playing in our society." West Point now requires every cadet to study data processing from his freshman year through graduation.

It is the purpose of this paper to outline some of the educational applications of data processing and to give a thumbnail sketch of what it does and why it is important.

APPLICATIONS

I. Student Body Reports

Master files including the student name, address, age, sex, major, minor, class standing, student number, and other desirable information can easily be maintained. Every school must keep a master file of basic information on each student. This master file may also include health records and permanent cumulative data. All of these records can be maintained by electronic data processing equipment.

II. Grade Reporting

This activity can relieve the teacher of much of the clerical activity he must perform. At the end of the reporting period the teacher must turn in one card for each student in his class with the grade mark on the card. This may be written in pencil or ink to be punched in the card by a key-punch operator, or the grade may be recorded on a mark-sensed card which will cause the grade to be punched into the card automatically when run through a reproducer with a mark sensing attachment. All grade cards for this student will be put in sequence with another card which contains the student's cumulative grade information; and a final grade report will be generated with the following data: student identification, semester hours enrolled, semester hours earned, semester hours attempted, semester hours failed, grade points earned, semester grade point average, cumulative hours earned, and accumulations of each of the preceeding items. A printed report of this is sent to the student, and an updated master card is generated for use the next time a grade report is needed.

Related grade reports may be desirable. For example, mid-semester notices to parents or deficient grade reports may be prepared. For the notice to parents, the teacher may voluntarily prepare a card indicating that the student is performing outstandingly well, near failing, performing poorly on tests, not preparing for classes, not completing written work, poor study habits, citizenship problem, excessive absences, or excessive tardiness. This would probably be reported on a mark sensed card and a report then sent to the parents. The deficient grade report would be used administratively. It would include an alphabetic listing of students receiving D's, F's, and incompletes. It would identify the student by name, list the grade received, teacher's name, current test data, grade point average, and rank in class. The guidance personnel would then use this report when advising students.

III. Testing

This educational application of EDP covers two types of testing: classroom testing, and psychological testing for guidance. Many programs have been written to make the grading and analyzing of tests automatic. The student would mark his answers on a mark sensed card, the card then punched and then run through the computer. The computer then prints the student identification, number of questions answered correctly, number of questions answered incorrectly, percentage grade, rank in class, and many other bits of data. The test itself can be analyzed to see what questions were missed, the mean, the median, the standard deviation, and an analysis of each question. This is a great service to the teacher. Furthermore, the equipment can print copies of the tests or can prepare masters or stencils to be used in duplicating the tests.

The many multiple-choice psychological tests administered by schools can also be graded and analyzed by the computer. The generated report can show areas of strength as well as areas of weakness. This data can be used to great advantage by the admissions and guidance personnel in advising students and in program making.

IV. Pupil Accounting

One of the areas that requires a lot of report preparation is that of pupil accounting. Some of the reports which can be prepared by the EDP equipment are attendance reports, absentee reports, withdrawal reports, late enrollment reports, and irregular attendance analysis. The importance of these reports is obvious to those working with school budgets and taxing units.

V. Scheduling

Many schools are using the computer for scheduling activities. This includes the preparation of class roles automatically, class admit cards, student program cards, teacher programs, room assignments, and time schedules. Computers can be programmed to relieve the administrative personnel of this time-consuming task and can prepare schedules which would require very little hand processing or correcting. There will probably always be some students whose programs cannot be satisfactorily prepared by the computer (as there are always cases when schedules are prepared by administrative personnel not using data processing equipment,) but these will be altered manually to fit into the master schedule prepared by the computer.

VI. Library Services

It is now possible to automate the library. Books can be checked out without the aid of the librarian. Reports can be generated by the computer showing the location of library books; the usage of each book by students and by faculty; the overdue book list; library unpaid fine list; book inventory and circulation report; and a library circulation statistical report which includes the period covered date, student use, faculty use, number of books used within each Dewey Decimal System classification, and grade totals. Furthermore, a complete catalog of library books and periodicals can be maintained by EDP equipment.

VII. Departmental Reports

There are many reports by department that a school may desire. Some of these which can be prepared automatically are: a course offering analysis, an analysis of teacher load, report on class load, and a departmental analysis. The number of departmental reports would depend on the desires and needs of the department.

VIII. Business Office Applications

The school business office can use the computer for many of the applications used by the industrial business office. Some applications of EDP for the school business office might be: payroll, purchasing, inventory control, cost analysis, budget reports, fee assessment, scholarships, equipment inventory, student loan and aid, physical plant (space utilization), and job costs.

IX. Bus Schedules and Routes

Through linear programming, the best possible bus route can be computed. The schedule for this route can also be prepared automatically.

X. Registration

A packet of cards is prepared for the student to use in registering. These would include an address statistical card, a continuing education card, an identification card, a registration summary card, a health appraisal and registration appointment card, and a permanent record summary card. Some schools would also include a church affiliation card. From these cards the following items could be calculated: hours enrolled, regular fees, special fees, basic student identification, health records, and mailing lists for both students and parents.

XI. Research

Many kinds of research can be enhanced by data processing equipment. Institutional research can be greatly benefited. Calculations for research conducted by both faculty and students can greatly increase the effectiveness, quality, and depth of the studies. Some of the studies commonly made which utilize data processing equipment are: correlations between test scores and test grades, tabulation of frequency distribution of course grades by test scores for use in selecting cut-off scores for special admissions and academic placement, evaluating the effectiveness of placement, follow up of students who have transferred to senior institutions, comparing grade-point averages of the junior and senior institutions, calculation of mean grade-point averages for the school in various subgroups, and a study of the effectiveness of various remedial or preparatory courses.

XII. Teaching EDP

One of the major applications of data processing is the teaching of data processing itself. The teaching of data processing is usually divided into three areas: unit record keeping, programming and operating the computer, and systems. EDP is currently being taught on the high school level, the junior college level, and the university level. There are some schools which train key-punch operators while others offer the Ph. D. degree with a major in computer science.

DEVELOPMENT OF A NEW EDP COURSE

J. M. Flannery

August 12, 1965

Development of EDP 104, Computer Business Problems

This course was developed to provide a problem-oriented data processing course for students of business who do not intend to take any of the programming work offered. They are those who will not work directly with data processing equipment but will need to understand how machines can be utilized to solve business problems.

The training will enable the graduates to assemble the information needed for a particular application in the best manner to assure efficient input preparation, to plan the flow of work through the processing system and to produce the desired output documents.

Although the students will actually use the various hardware components in the laboratory, the emphasis is on the solution of the problems rather than how the machines do the work. The objectives are an understanding of the functions of the various machines and how a task can be accomplished in terms of these functions. Because of this, the students will not be required to do any extensive wiring or program writing.

It is anticipated that this course, while of primary benefit to the accounting student, will be very useful to all students who plan careers in business.

PREFACE

EDP 104, Computer Business Problems, is a synthesis course designed to provide an opportunity for advanced analyses and processing of business data in the most efficient manner available. Prerequisites for the course include either EDP 102, EDP 103, or BUA 112. EDP 104 is required of all one-year automated machine accounting and two-year accounting majors. It is recommended as an elective to any student interested in business data processing after one of the above prerequisites has been completed.

The outline is divided into eight blocks, which allows a review of available electronic and punch card equipment and possible applications of each machine. The class meets three clock hours a week with additional laboratory time, and three hours' credit are awarded for satisfactorily completing the requirements.

Since the final purpose of learning the capabilities of any equipment is the use of such knowledge in obtaining desired results, emphasis in this course is placed on the student's ability to take source data, interpret it, and proceed with the necessary stages to the proper output. Consequently, it is primarily a laboratory course with a minimum of formal lecture. The second half of the classwork includes complex business case studies involving areas of business accounting where data processing equipment is most frequently employed.

Company reference manuals and departmental problems provide the necessary instructional materials for the course. Supplementary materials include textbooks and/or manuals used in prerequisite courses.

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II.	DATA INPUT--IBM 026 CARDPUNCH AND FRIDEN FLEXOWRITER	1
III.	IBM 082 SORTER AND IBM 557 INTERPRETER	1
IV.	IBM 077 COLLATOR	2
V.	IBM 519 DOCUMENT-ORIGINATING MACHINE	2
VI.	IBM 407 ACCOUNTING MACHINE	3
VII.	IBM 1620 COMPUTER	3
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OBJECTIVES

1. To aid the student in learning to analyze and process business information in terms of available equipment.

2. To provide a review of the primary functions and capabilities of both unit record equipment.

3. To develop an awareness of the most efficient procedures in the conversion of data to the desired output documents, reports, etc.

4. To differentiate between facts and myths prevalent in the data processing field.

SUGGESTED BREAKDOWN OF CLASS HOURS

BLOCK		
I.	ORIENTATION AND INTRODUCTION	1
II.	DATA INPUT--IBM 026 CARDPUNCH AND FRIDEN FLEXOWRITER	2
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Course Outline

BUSINESS DATA PROCESSING PROBLEMS

EDP 104

BLOCK I - ORIENTATION AND INTRODUCTION

A. Departmental Regulations

B. Course Objectives

C. Course Overview

D. Grading and Testing Procedures

E. Necessary Supplies

F. Background Information
  1. History
  2. Terminology
  3. Current and projected applications

G. Scientific Problem Solving Process
  1. Problem definition
  2. Data organization
  3. Development stage
  4. Testing

BLOCK II - DATA INPUT--IBM 026 CARDPUNCH AND FRIDEN FLEXOWRITER

A. The IBM Card
  1. Physical characteristics
  2. Hollerith code
  3. Card design
  4. Fields

B. IBM 026 Cardpunch
  1. Operating features
  2. Program control mechanism

C. Friden Flexowriter
  1. Operating features
  2. Tape conversion
  3. Edge card

BLOCK III - IBM 082 SORTER AND IBM 557 INTERPRETER

A. IBM 082 Sorter
  1. Physical sorting

        - a. Numerical
        - b. Alphabetical
    - 2. Functional switches
    - 3. Block sorting
    - 4. Control sorting

- B. IBM 557 Interpreter
    - 1. Purpose
    - 2. Available models
    - 3. Functional controls and switches
    - 4. Functional wiring control

BLOCK IV - IBM 077 COLLATOR

- A. Introduction
    - 1. Purpose
    - 2. Available models

- B. Machine Operation
    - 1. Machine parts
    - 2. Functional switches
    - 3. Feeds
        - a. Primary
        - b. Secondary
    - 4. Card pockets
    - 5. Typical operations

- C. Wiring
    - 1. Merging
    - 2. Matching
    - 3. Selection
    - 4. Sequence checking
    - 5. Combinations

BLOCK V - IBM 519 DOCUMENT-ORIGINATING MACHINE

- A. Introduction
    - 1. Principal uses
    - 2. Available models

- B. Operation
    - 1. Functional controls
    - 2. Machine parts
    - 3. Card feed units
        - a. Read unit
        - b. Punch unit
    - 4. Comparing unit
    - 5. Typical operations

C. Wiring
  1. Reproducing
  2. Gangpunching
  3. Comparing
  4. Summary punching

BLOCK VI - IBM 407 ACCOUNTING MACHINE

A. Introduction
  1. Purpose
  2. Available models

B. Machine Operation
  1. Functional controls
  2. Machine parts
  3. Print unit
  4. Tape-controlled carriage
  5. Typical operations

C. Wiring
  1. Detail printing
  2. Group printing
  3. Program control
  4. Machine calculation

BLOCK VII - IBM 1620 Computer

A. Introduction
  1. Purpose
  2. Auxiliary units

B. Program
  1. Language
  2. Control

C. Machine Operation
  1. Functional controls
  2. Typical operations

BLOCK VIII - CASE STUDY PROBLEMS

A. Introduction
  1. Problem analysis
  2. Flow charting
  3. Card design
  4. Printed layouts
  5. Output formats

B. Case Studies
  1. IBM case study--sales accounting

  - a. Invoice printing
  - b. Emission of dates
  - c. Computation of sales tax
  - d. Invoice totals
2. Friden department store--retail accounting
   - a. Accounts payable
   - b. Accounts receivable
   - c. Inventory
   - d. Ledger control cards
3. Inventory analysis
   - a. Master, detail, and receipt cards
   - b. Beginning inventory--quantity and value
   - c. Ending inventory--quantity and value
4. Monthly payroll
   - a. Master, detail, and summary cards
   - b. Month's payroll with weekly breakdown
   - c. Year-to-date and quarter-to-date summaries

METHODS EMPLOYED

A. Lectures

B. Teacher and student demonstrations

C. Films, overhead projectors, and other visual aids

D. Practical laboratory experience

STUDENT ACTIVITIES

A. Plan laboratory problems on individual machines on a planning sheet and perform necessary functions to solve the problems.

B. Analyze, design layouts, flow chart, and process various machine stages necessary to complete case studies.

C. Be responsible for materials in reference manuals and related information presented either in visual or written form.

INSTRUCTIONAL MATERIALS

A. Textbook: Salmon, Lawrence J., IBM Machine Operation and Wiring.

B. IBM Functional Wiring Manual

C. IBM Operator's Guide

D. Departmental and IBM Case Study Problems

E. Individual departmental problems

STUDENT EVALUATION

A. Class participation

B. Case study problems

C. Individual machine problems

D. Mid-term and final examinations

E. Class tests and short quizzes

F. Class attendance

BIBLIOGRAPHY

Salmon, Lawrence, J. IBM Machine Operation and Wiring. Belmont, California. Watsworth Publishing Company, 1965.

IBM Operator's Guide. Endicott. International Business Machines Corporation, 1965.

IBM Functional Wiring Manual. Endicott. International Business Machines Corporation, 1965.

Flannery, John and Scates, Doris. Unit Record Laboratory Problems. Business Education Department. Miami-Dade Junior College. Miami, Florida. Mimeographed form.

Scates, Doris and Flannery, John. Business Case Study Problems. Business Education Department. Miami-Dade Junior College. Miami, Florida. Mimeographed form.

EDP 104
Laboratory Problems

I. Key Punch

1. Punch a card as follows:

Card col.	Information
1	1
2	0
3-5	104
6-7	00
8-14	Your Student Number
15-16	" Initials
17-34	" Name
35-52	" Address
53	" Sex
54-59	001500
60-61	01
62-65	0268
66-69	0300
70-73	0200
74	1
75-78	4000
79-80	Skip

This is a typical Payroll Master card.

2. Make a program card to be used for punching many Payroll Masters.
   a. Plan the card first using a program card planning sheet.
   b. Punch your program card from the planning sheet..

3. Using the program card, punch these Payroll Masters:

Card Code	Dept.	Emp#	Soc Sec#	Name & Address	Sex	Rate	Ex.	Ins.	Union	Other	Code	Reg. Hours
1	4	375	105121462	KBMANDEVILLE 218 CURTISS PKY MS	2	001500	01	0000	0200	0250	1	4400
1	3	362	080099562	MKFLYNN 5862 Sw 40 Ave. MIA	1	001650	05	0357	0400	0000	0	4000
1	2	305	032192150	NFSTAMES 6245 SW 72 AVE SM	1	002100	03	0357	0600	0600	1	4000
1	2	386	026101368	C KIMBALL 3743 NW 70st HIAL	1	002075	02	0268	0600	0000	0	4000
1	1	340	162205341	JKKURTZMAN 159 NE 129 ST MIA	2	002100	04	0357	0000	0000	0	4000

II. Sorter

*1. Sort the Masters alphabetically.

2. Select all employees of Dept. No. 3.

3. Select all employees whose surname begins with A or J.

*80-80 listing to be made on 407.

*4. Select all employees who do not belong to a union.

5. Sort your Payroll Master cards by Dept. and I. D. number with count.

III. Interpreter

1. Interpret, on print line 1, your student cards.

2. Interpret on print lines 1 & 2, the Payroll Master cards. Follow print format of original Masters.

   Note how, with a machine equipped with two print entries, this job could be accomplished with one panel instead of two. Note also that the cards would have to pass through the machine twice in either event.

IV. Reproducing Punch

*1. Using the Payroll Masters as originals and the Gang Punch Masters provided, produce Payroll Detail cards for the first 2 weeks of the year.

2. Using the Details from problem #1, and the Gang Punch Masters provided, produce a set of summary cards to begin the year.

3. Using the payroll summary and Detail cards provided, produce, on the Accounting Machine, a weekly Payroll Journal Listing and the new summary cards.

V. Collator.

*1. Using your Payroll Masters and Details, match/merge the cards (Details following Masters) and check sequence.

*2. Using the merged deck from problem No. 1, merge the summary cards behind previously merged cards, checking sequence.

VI. Accounting Machine

1. Using the Sales cards furnished, run a listing of the weekly sales showing all detail for each salesman.

2. Accumulate a final total for previous problem.

3. Using the same cards, run a sales analysis report showing totals by salesman and branch. Accumulate a final total.

4. Using the Payroll cards you have, run a listing of the weekly Payroll Journal, accumulating totals for Gross Pay, W. T., FICA, Ins. and Net Pay.

*80-80 listing to be made on 407.

5. Using the On Hand, Sales & Purchases cards provided, run a Stock Status Report showing, for each stock number, old On Hand Balance, Sales, Purchases and compute, by crossfooting, the New On Hand Balance.

6. Using your Payroll cards, compute net pay and print totals for each field for first week.

CASE STUDY NO. I

You are to prepare a diagram which you will use to wire a control panel that will print the invoices shown on the following pages. Card forms to be used are on following pages.

You will find that the best approach to solving the case study is to plan, wire, and test it in parts:

First, wire for Sold To, Ship To, Via, Salesman's Name, Order No., and Order Date, in the heading, and Item No., Description, and Quantity, in the body. Test this completely before continuing.

Next, add Branch No., Customer No., and Date, including overflow indication, in the heading, and Unit Price, and Amount, not including Sales Tax and Invoice Total, in the body.

The date is to be emitted.

Finally, add Page No. and Invoice No. in the heading, Sales Tax and Invoice Total in the body, and carriage wiring.

The initial Invoice No. is to be taken from a special single x 78 header card, and increased by one for each invoice.

The 2% Sales Tax is to be computed by transferring totals, and is then to be added to the Amount Total to develop Invoice Total.

When you have finished this problem, turn in flow chart, diagram, cards, and printed output.

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IBM EDUCATION CENTER

SOLD TO

PAGE NO.	INVOICE NO.	BRANCH NO.	CUSTOMER NO.	DATE
2	4445	132	3251	1/18/66

SHIP TO

VIA

SALESMAN'S NAME	ORDER NO.	ORDER DATE

ITEM NO.	DESCRIPTION	QTY.	UNIT PRICE	AMOUNT
6890	HERRING	2	1425	2850
7823	LAUNDRY SOAP	2	698	1396
7928	SARDINES	1	710	710
8013	CAKE MIX	1	1015	1015
8951	TUNA FISH	1	898	898
9012	MACARONI	3	1032	3096
				41281
			SALES TAX 2%	$ 825
			INVOICE TOTAL	$ 42106

IBM

▼

You have now wired an IBM Accounting Machine to produce an invoice. An invoice problem requires the use of many features on the machine, including the tape controlled carriage, printing of heading cards, counter control, selectors, special programming, summary punching, and overflow indication.

The wiring principles you have used in this problem can be applied to reports of any nature, including sales analysis, inventory, accounts receivable, aged trial balance, daily time sheets, production schedules material requirements, government reports, withholding statements, payroll checks, and payroll deduction lists.

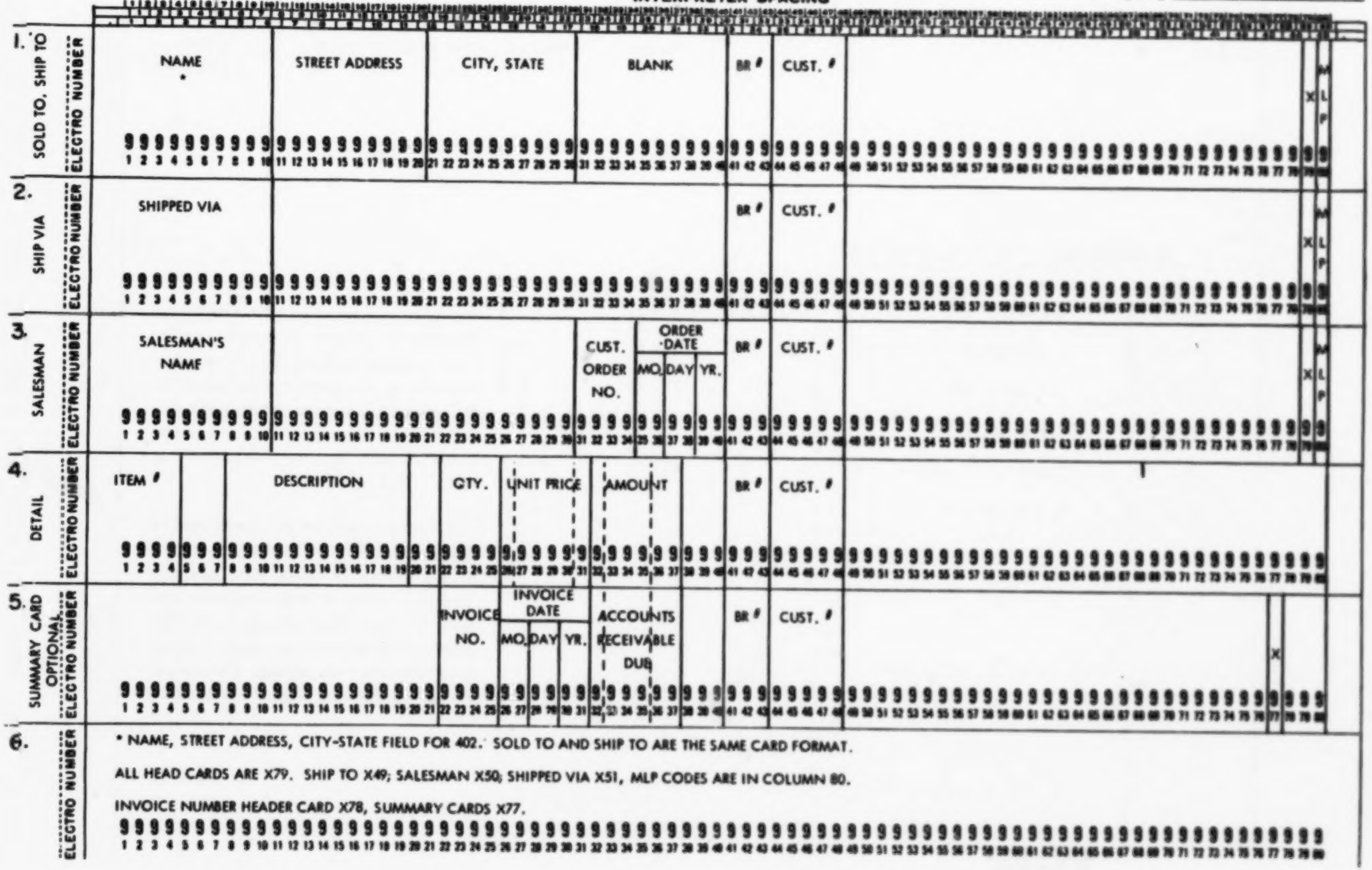
MULTIPLE LAYOUT FORM

FOR ELECTRIC ACCOUNTING MACHINE CARDS

INTERPRETER SPACING

402, 403 CASE STUDY CARD FORMS

DATE 1/19/66



1. SOLD TO, SHIP TO — ELECTRO NUMBER
NAME * | STREET ADDRESS | CITY, STATE | BLANK | BR # | CUST. # | X | M L P

2. SHIP VIA — ELECTRO NUMBER
SHIPPED VIA | BR # | CUST. # | X | M L P

3. SALESMAN — ELECTRO NUMBER
SALESMAN'S NAME | CUST. ORDER NO. | ORDER DATE MO. DAY YR. | BR # | CUST. # | X | M L P

4. DETAIL — ELECTRO NUMBER
ITEM # | DESCRIPTION | QTY. | UNIT PRICE | AMOUNT | BR # | CUST. #

5. SUMMARY CARD OPTIONAL — ELECTRO NUMBER
INVOICE NO. | INVOICE DATE MO. DAY YR. | ACCOUNTS RECEIVABLE DUE | BR # | CUST. # | X

6. ELECTRO NUMBER

* NAME, STREET ADDRESS, CITY-STATE FIELD FOR 402. SOLD TO AND SHIP TO ARE THE SAME CARD FORMAT.

ALL HEAD CARDS ARE X79. SHIP TO X49; SALESMAN X50; SHIPPED VIA X51, MLP CODES ARE IN COLUMN 80.

INVOICE NUMBER HEADER CARD X78, SUMMARY CARDS X77.

CUSTOMERS NAME & NO. ____________________

ADDRESS ____________________

CASE STUDY NO. 2

Friden Department Store

Inventory Analysis

Dept.	Item No.	Item Description	Cost	Retail	On Hand
11	501	Sheets	2.00	3.95	500
11	502	Pillow Cases	.65	1.20	500
11	503	Towels	.85	1.98	1,000
11	504	Bath Mats	2.50	4.95	350
11	505	Bedspreads	22.50	39.95	175
12	551	Portable Mixers	6.00	11.95	80
12	553	Can Openers	5.50	12.00	55
12	554	Electric Skillets	12.95	25.00	100
12	560	Blenders	15.00	29.95	50
12	594	Electric Irons	8.95	12.50	250
13	601	Sofa	125.00	250.00	10
13	605	Sofa	290.00	480.00	5
13	609	Sofa	510.00	1,000.00	3
13	610	Chair, Recliner	25.00	49.95	50
13	625	Dining Table	110.00	219.95	5
13	626	Chairs, Dining	25.00	49.50	30
13	630	Lamps	9.00	18.00	100
13	640	Bed	100.00	199.95	10
13	641	Dresser	59.95	120.00	10
13	642	Chest	85.00	170.00	10
14	651	Air Conditioner	250.00	395.00	25
14	652	Air Conditioner	298.95	450.00	15
14	653	Air Conditioner	129.50	170.75	108
14	661	TV Set	89.50	179.50	80
14	663	TV Set	105.00	199.95	88
14	672	Sewing Machine	75.00	149.50	241
14	683	Stereo	694.50	1,285.00	25

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DS:hy

A. Monthly Purchase Report

. Using inventory deck for Friden Department store, group print month's receipts vendor by item number, totaling both on minor. Take an intermediate on item and summary punch quantity. Take a major total on receipt dollar value and summary punch into General Ledger card.

B. Monthly Stock Status

Using inventory deck, compute new On Hand stock count.

Procedures

1. Sort sales transaction cards by item number and run through 407 on one counter with card count impulse. Summary punch to get depletion of inventory.

2. Take summary cards, run through 407, group printing by item number the old balance, the purchases sales, and new on hand balance. Program item on minor and summary punch a new on hand card.

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IBM

INTERNATIONAL BUSINESS MACHINES CORPORATION

MULTIPLE-CARD LAYOUT FORM

Form X24-6599-0
Printed in U. S. A.

Company EDP 104
Application Retail-A/C Payable by ______ Date ______ Job No. 002 Sheet No. 1

	Date		A/C#	Title	Old. Bal.	Cr. Am't	Dr. Am't	New Bal.	
Gen'l Ledger	9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9 9 9
	1 2 3 4 5 6 7	8 9 10 11 12 13 14 15	16 17 18	19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38	39 40 41 42 43 44 45 46	47 48 49 50 51 52 53 54	55 56 57 58 59 60 61 62	63 64 65 66 67 68 69 70	71 72 73 74 75 76 77 78 79 80

9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

	Date		Vend No.	Name	Old. Bal.	Cr. Am't	Dr. Am't	New Bal.	
A/C Pay Mstr.	9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9 9 9
	1 2 3 4 5 6 7	8 9 10 11 12 13 14 15	16 17 18	19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38	39 40 41 42 43 44 45 46	47 48 49 50 51 52 53 54	55 56 57 58 59 60 61 62	63 64 65 66 67 68 69 70	71 72 73 74 75 76 77 78 79 80

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

	Date	Ck.#	Item	Wk	Vend No.	Name		Cr. Am't	Dr. Am't		P.O.	Dr code	k.
Transaction	9 9 9 9 9 9 9	9 9 9	9 9 9	9 9	9 9 9	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9 9 9 9 9	9 9 9 9	9	9
	1 2 3 4 5 6 7	8 9 10	11 12 13	14 15	16 17 18	19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38	39 40 41 42 43 44 45 46	47 48 49 50 51 52 53 54	55 56 57 58 59 60 61 62	63 64 65 66 67 68 69 70 71 72 73 74	75 76 77 78	79	80

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

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INTERNATIONAL BUSINESS MACHINES CORPORATION

MULTIPLE-CARD LAYOUT FORM

Form X24-6599-0
Printed in U. S. A.

Company EDP 104

Application Retail- A/C Rec. by ______ Date ______ Job No. 002 Sheet No. 2

Gen'l Ledger		Date		A/C#	Title	Old. Bal.	Dr. Am't.	Cr. Am't.	New Bal.		
	9	9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9 9	9
	1	2 3 4 5 6 7	8 9 10 11 12 13 14 15	16 17 18	19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38	39 40 41 42 43 44 45 46	47 48 49 50 51 52 53 54	55 56 57 58 59 60 61 62	63 64 65 66 67 68 69 70	71 72 73 74 75 76 77 78 79	80

9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9
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A/C Rec Mstr.		Date		Cust No.	Title	Old. Bal.	Dr. Am't.	Cr. Am't.	New Bal.		
	9	9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9 9	9
	1	2 3 4 5 6 7	8 9 10 11 12 13 14 15	16 17 18	19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38	39 40 41 42 43 44 45 46	47 48 49 50 51 52 53 54	55 56 57 58 59 60 61 62	63 64 65 66 67 68 69 70	71 72 73 74 75 76 77 78 79	80

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

Transaction		Date	Dpt	s	Itm	Wk.	Cust No.	Description		Dr. Am't.	Cr. Am't.	Codes 1. Return 2. Allowance	Cr. Code	
	9	9 9 9 9 9 9	9 9	9	9 9 9	9 9	9 9 9	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9	9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	9	9
	1	2 3 4 5 6 7	8 9	10	11 12 13	14 15	16 17 18	19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38	39 40 41 42 43 44 45 46	47 48 49 50 51 52 53 54	55 56 57 58 59 60 61 62	63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78	79	80

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

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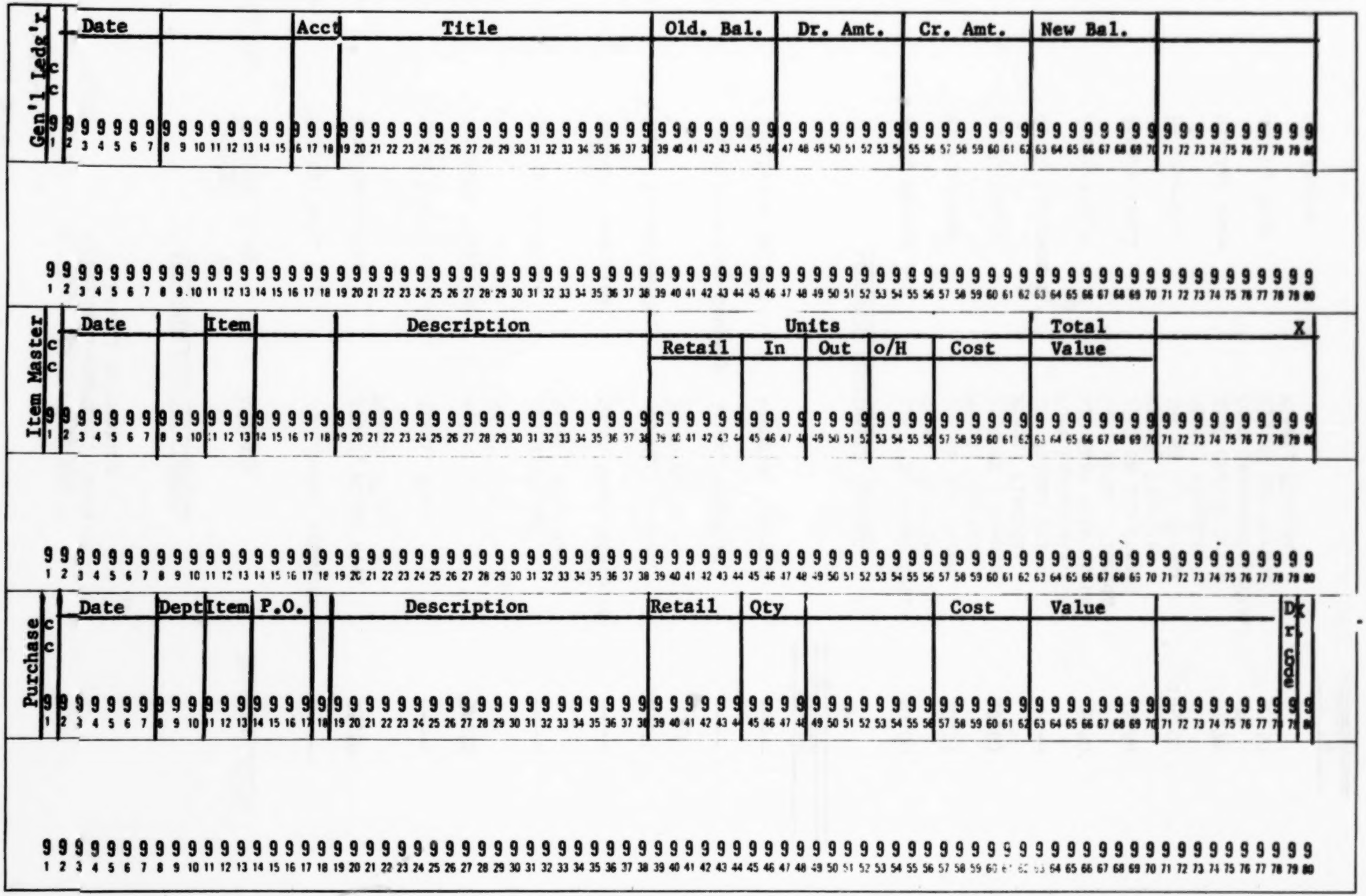
INTERNATIONAL BUSINESS MACHINES CORPORATION

MULTIPLE-CARD LAYOUT FORM

Form X24-6599-0
Printed in U. S. A.

Company EDP 104

Application Retail - Inventory by ______ Date ______ Job No. 002 Sheet No. 3


Gen'l Ledg'r
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Title
Old. Bal.
Dr. Amt.
Cr. Amt.
New Bal.
Item Master
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Out
o/H
Cost
Total
Value
X
Purchase
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Date
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Item
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Description
Retail
Qty
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Dr
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code
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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

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EDP 104 CASE STUDY NO. 3
Friden Department Store
Retail Accounting

ACCOUNTS PAYABLE CONTROL

Cust. No.	Vendor/ Customer Name	Address	Balance 1/1/66
510	Paschal Mfg. Co.	Jonesboro, Arkansas	——
514	Long Domestics	850 N. Miami Ave. Miami, Fla.	25.50
518	Miami Electrical Co.	Miami, Fla.	——
520	Southern Suppliers	Main St. Louisville, K.	34.25
604	General Machines	415 N. Miami Miami, Florida	——
721	Midwest Domestics	South Bend, Missouri	——
749	Jones Furniture Co.	134 Main Street Hickory, N. C.	249.50
750	Black Furniture Company	Galax, Virginia	——
801	Electrics Unlimited	Augusta, Georgia	——
			309.25

ACCOUNTS RECEIVABLE CONTROL

381	R. H. Madden	12550 N. Miami Ave. Miami, Florida	50.00
390	W. J. Jones	125 NE 149 Street Miami, Florida	10.55
411	B. F. Weare	9550 NE 6 Avenue Miami, Florida	49.63
67	J. R. Anderson	128 Island Drive Fort Lauderdale,Fla.	——
455	James McDuff	420 East Main Street Lake Wales, Florida	5.90
31	Robert Kroll	2540 SW 120 Street Miami, Florida	75.80
140	Ed Chennett	284 NE 128 Street Miami, Florida	195.00
50	William Bare	2340 Croton Drive Fort Lauderdale, Fla.	3.75
280	Joe R. Ryan	235 SW 120 Street Miami, Florida	30.50
79	Jim Ermine		
			421.13

CASE STUDY NO. 3

Using Friden Department Store, Deck M plan, flow chart, and run the following information:

A. Accounts Receivable
   1. Prove daily cash and Accounts Receivable files. Last card total with listing off. X80 cards are cash sales.

   2. List item by department and day with item count.
      Item--minor
      Department--intermediate
      Day--major Use card cycles impluse for item count.
   Subtotal on each program and take a final total using LCT.

   3. Group print totals by salesman, department, and day. Program salesman on minor, department on intermediate, and day on last card program start.

   4. Group print sales by department by week and month. Dept. on minor, week on inter. and print monthly total manually. Accumulate for final total only cash and credit sales. Print asterisk after each cash sales.

   5. Group print customer by month and summary punch subsidiary card. Accuumulate General Ledger totals and summary punch.

B. Accounts Payable
   1. Detail print Purchase Order Register. Print asterisk after each debit. X80 cards are debit cards.

   2. Group print purchases by item and vendor. Program item No. on minor, vendor on intermediate, and monthly total on major. Summary punch on inter. and major to subsidiary accounts.

C. Profit/Loss
   Group print sales, cost of sales, and gross profit by item and department for month.. Item, on minor, dept. on intermediate and LCT major. Cost is X on low order of field.

   Procedures.
   1. (Sort) sales by Item # with Item Master cards preceding transaction cards.

   2. Intersperse Gang Punch cost into transaction card.

   3. Select by sorting Item Masters.

   4. Sort transaction cards by dept.--check to be sure cards are in item sequence within depts.

   5. Run profit/loss statement.

EDP 104

CASE STUDY
No. 4

PAYROLL

In this case you will process four weekly payrolls producing for each employee, each week; a pay check and a cumulative earnings record. You will also produce a weekly Payroll Journal and, at the end of the month, a deduction register.

After reading the procedure and discussing it with your instructor, draw a flowchart showing how you will do the job. When your chart has been approved, begin processing.

PROCEDURE:

Step 1. List the Master cards you have been given and compare to the list at the end of this section.

Step 2. Print on the Masters the punched information according to the format shown in the example.

Step 3. Arrange the Master and Weekly cards in ascending sequence by Department and I.D. number.

Step 4. Arrange each Master ahead of the corresponding Weekly card. Separate any, from either deck, that do not match. Be sure the combined deck is in proper sequence.

Step 5. Using the cards from Step 4, transfer the "Standard Deductions" data from the Masters to the Details. Observe this schedule for deductions:

Group Insurance deducted weeks 1 & 3.
Union Dues " " 2 & 4.
Other " each week.

Step 6. List the Detail cards produced in Step 5. and compare your results with the list shown in the example. Make necessary corrections.

Step 7. After verifying your cards, put the Cumulative Summary cards behind the Masters and Details for each employee. Separate any unmatched cards.

Step 8. List the payroll checks for the week. To do this, all pay and deduction fields must be crossfooted to determine net pay. The checks are to be written on three lines as shown in the example.

EDP 104 Case Study No. 4

Step 9. While printing the checks in Step 8., produce new Cumulative Summary cards. Separate the old Summaries and file them.

Step 10. Write the Payroll Journal:

A. Show for each employee;
Dept., I.D., Soc. Sec., name, exemptions, hours, other pay, gross, each deduction, net pay and check number.

B. Indicate for each department;
Totals of hours and all dollar amounts with a count of number of employees.

C. Print final totals at the end of the report for all items listed in B.

Step 11. Separate Masters and Details and file them.

This completes the first weekly payroll. After having your work checked by your instructor, repeat only those steps necessary to accomplish the same output documents for the second week. Have this work checked by the instructor.

During the third week, there will be some additions and other changes to the payroll. After receiving the cards, documents and other information, draw a flowchart showing how you will process the changes and the changed payroll. Do no processing until your instructor has approved your chart. Then complete the payrolls for weeks 3 and 4.

* *

At this point in the case, an accounting period has elapsed and the General Ledger accounts of the business must be posted. Your Payroll Journals will be the basic document used to post several expense and liability accounts. The final report you produce will demonstrate a procedure by which the information posted from the other reports can be rearranged to give new emphasis and meaning and, most important, verify the work previously done.

Step 12. Arrange the Detail cards (all four weeks) for each employee behind a Master card.

Step 13. Print a Deduction Register according to the format in the example.

The procedure used here differs from the weekly payroll routine but, all control totals are identical. This verifies that you have all the original documents (cards) and the information in them is unchanged. Can you suggest another way, using other cards, to achieve the same verification?

A GUIDE FOR THE TEACHING OF DATA PROCESSING

Curtis J. Kinney

August 11, 1965

A GUIDE FOR THE TEACHING OF DATA PROCESSING

Statement of the Problem:

At the present time the teaching of data processing is of great importance. Very few teachers are adequately prepared to present the subject matter of data processing in a clear, logical manner. Textbooks in this new field are completely inadequate. It is the purpose of this paper to present some materials and methods for the teacher's use in teaching data processing.

The first part will be an outline for the teacher to use when presenting the South-Western Publishing Company's material, Automation Office Practice, by Wanous and Wanous, and the corresponding practice set, Automation Office Practice Set. The second part is devoted to the presentation of machine language programming for the IBM 1620 computer. There are as many different approaches to this topic as there are teachers of data processing, but it is hoped that this pattern will be a feasible one to follow to attain maximum learning on the part of the students.

The third part of this paper is devoted to the teaching of 1620 SPS programming, and the fourth part introduces programming in Fortran for the IBM 1620 computer. The programming sections make some basic assumptions. It is assumed that the student knows and understands about op codes, mnemonics, P and Q addresses, fields, records, flags, direction of internal transmission of data, and the location of the product area and tables. It is the intent to begin with this group of assumptions, introduce a minimum program, have the student modify this program, add to the program, further modify it, etc., always bearing in mind the student's present knowledge and working toward a maximum program.

PART I - AN OUTLINE FOR THE TEACHING OF AUTOMATION OFFICE PRACTICE

UNIT I - INTRODUCTION

I. Who can learn data processing?
   A. General understanding
   B. Machine operator
   C. Programmer

II. Hand in final examination

III. History of automation

IV. Data-processing cycle
   A. Source documents (raw materials)
      1. Time cards
      2. Invoices
      3. Sales slips
      4. Checks
   B. Recording the information in a form that permits convenient manipulation
      1. Payroll register
      2. Punched card
   C. Actual manipulation of the record
      1. Classification
      2. Calculations are made
      3. Summaries are made
   D. Preparation of the final report or product
      1. Pay checks
      2. Printed inventory report
   E. Storage - This applies to each of the above 4 steps

It is important to note that these steps are involved in processing data either by hand (manually) or by machine (automatically).

V. Automation is a process in which work is done automatically with a minimum amount of human effort

VI. Examples of automatic processes
   A. Window envelopes
   B. Carbon paper
   C. Charge plates
   D. Peg board
   E. Keysort

VII. Automation as applied to office work is NEVER completely automatic

VIII. Automation is a process, not a machine

IX. If a machine is to be used, original records must be translated into a code or language that can be understood by the machine

X. Punched cards and paper tape
   A. Printed matter must be translated into a special language or code
   B. The holes allow the electrical contacts to be made to cause the machine to do something

XI. Information of the codes used in data processing
   A. Herman Hollerith - Rectangular holes - IBM
   B. James Powers - Round holes - Remington Rand Univac Division of Sperry Rand Corporation
   C. 1880 Census
      1. Too slow
      2. Possibility of error too great
      3. Finished in 1887
      4. Code invented in 1887 for tabulating electronically through a sensing device. This was the beginning of office automation as it is known today.

XII. Reasons for need for automation
   A. More people - 170 million in Social Security records by 1970
   B. More office employees
      1. 1900 - 1 out of 40 worked in an office
      2. 1940 - 1 out of 10 worked in office
      3. 1950 - It cost the Federal Government 5 billion dollars to process paper work
      4. 1965 - 1 out of 6 is engaged in clerical work
      5. 1965 - 11 billion dollars have been budgeted for processing paper work

XIII. Limitations of office automation
   A. Machines are complete idiots - they can do only what they are told to do
   B. It cannot think - it can do only repetitive tasks
   C. It is expensive

XIV. Two main divisions of automation machines
   A. Unit record equipment - tabulating system
   B. Computer equipment - electronic computer system

XV. Office machines that can communicate with one another through the medium of punched tape or cards are referred to as common language machines

XVI. Complete Study Guide 1

XVII. Complete Projects 1 and 2

UNIT II - RECORDING NUMERIC INFORMATION IN CARDS

I. The tabulating system of processing data automatically consists of 5 steps
  A. Source documents are prepared - raw materials
  B. The information is punched into cards or paper tape in code form - input
  C. Cards are classified and sorted - manipulation
  D. Information is summarized and tabulated - manipulation
  E. The processed data are printed in the desired form - output

II. The IBM Card
  A. 80 vertical columns
  B. 12 punching positions called rows
  C. Top edge is the 12 edge
  D. Bottom edge is the 9 edge
  E. 7 3/8 by 3 1/4 by .007
  F. Cost about $1 per thousand
  G. Can contain alpha or numeric information

III. Recording numeric information in the card
  A. When a hole is in the 6 position, it has a value of 6
  B. Any column may be used for a particular digit
  C. The card may be interpreted at the top
    1. By a printing key punch
    2. By an interpreter
  D. When a 2-digit number is to be recorded, 2 columns are necessary

IV. Numeric codes
  A. Must be useful
  B. Must be planned

V. Format - the printing on the card

VI. Fields - divisions of the card
  A. Each field contains a bit of information
  B. When recording numeric information, the zeros to the left of the significant numbers must be punched if you are ever to sort. A zero and a blank will sort in a different manner.
  C. High order position is left
  D. Low order position or units position is the right-hand number
  E. Fields MUST contain the same type of information
  F. The field MUST be punched correctly
  G. The maximum number of columns ever to be used must be reserved for a field

VII. Corner cuts
  A. Identify types of cards
  B. Insures uniform stacking

VIII. Types of cards
- A. Transcript - an original source document is transcribed onto a card
- B. Dual - original information is written on the card and then punched in
- C. Mark sense - marked with special pencil and punched automatically. This is an extension of the dual
- D. Summary - cards a, b, and c are manual or combination of automatic and manual while the summary is completely automatic

IX. Advantages of punched cards
- A. Versatile and durable - can be used over and over
- B. Card can contain printed or written matter
- C. Each card contains all the information needed for a single transaction

X. Complete Study Guide 2

XI. Complete Project 3

UNIT 3 - RECORDING ALPHABETIC INFORMATION IN CARDS

I. Punching areas
- A. Digits 0 - 9
- B. Zones
  - 1. 12 punch or y
  - 2. 11 punch or x

II. Alphabetic information requires one zone and one digit punch in the same column

A. 12 and 1 = A
2 = B
3 = C
4 = D
9 = I
B. 11 and 1 = J
C. 0 and 2 = S
9 = Z
D. The 0 and 1 are not used for an alphabetic character

III. Zeros left are not necessary in alphabetic coding - nor zeros right
Alphabetic fields are aligned left; numeric fields are alligned right

IV. Punctuation is usually omitted

V. Three ways of recording input data in cards
- A. Direct punching of cards
- B. Indirect punching of cards as a by-product
- C. Mark sensing

VI. Keyboard for keypunch
  A. Shift keys
    1. Num
    2. Alpha
  B. Feed
  C. Reg
  D. Dup

VII. Keypunch machine
  A. Keyboard
  B. Card supply
  C. Feed position
  D. Register at punching station
  E. Punch
  F. Release
  G. Feed
  H. Register at reading station
  I. Punch or duplicate
  J. Release
  K. Stack
  L. Backspace
  M. Program drum and card
    1. 12 punch identifies the length of the field - the absence of a punch indicates the beginning of a field
    2. 11 punch starts automatic skip
    3. 0 punch starts automatic duplication
    4. 1 punch is the alpha shift

See program card of page 28 of textbook.

  N. Training necessary to become keypunch operator
    1. Fair in 4 hours
    2. Good in 8 hours
    3. IBM has a 20-hour course
    4. An operator can make about 8,000 to 9,000 strokes per hour. The machine will not operate at more than 18,000 strokes per hour.

NOTE: The keypunch is an auxiliary part of an installation, but it is an integral part of the process.

VIII. Checking for errors
  A. Verifier
  B. Interpret
    1. By a printing keypunch
    2. By an interpreter
  C. Visual inspection of holes punched in cards

IX. Codes for special characters
  A. 26 letters of the alphabet
  B. 10 digits
  C. 11 special characters - See page 30 of textbook

X. Complete Study Guide 3

XI. Complete Projects 4 and 5

UNIT 4 - PUNCHED TAPE AND OTHER INPUT MEDIA

I. Remington Rand punched card
A. 90 columns
B. Divided in upper and lower halves
C. The two halves are read separately by the machine that processes the data
D. Only 1 zone punch at the top - it is used for the zero
E. Another zone punch is in the scale that identifies the vertical columns
F. Even digits are represented by a digit and a zone punch
G. Odd digits are represented by a digit punch only
H. Alpha characters are represented by 2 or 3 punches

II. Similarities of the IBM and Rem Rand punched cards
A. Both use punched holes as codes
B. A figure, letter, or character may be punched in any column
C. Both are processed mechanically through TIMED electrical impulses
D. Both are used to prepare the same types of reports automatically
E. Either may serve as an input medium as well as a source document
1. Check
2. Time card
3. Invoice

NOTE: Remember the types of cards - transcript, dual, mark sense, summary.

III. Mark-sense punching
A. Cards are marked with a graphite pencil
B. A machine called a reproducer reads these markings and punches holes
C. The cards are special
1. Each marking area covers 3 card columns
2. There are 27 total marking columns covering 81 card punching columns
D. Applications
1. Reading of utilities meters
2. Testing
3. Survey questionnaires
4. Record of materials needed
5. Recording hours of labor
6. Recording inventory of stock on hand

IV. Punched paper tape
A. An input medium for common-language machine
B. Can be processed much faster than punched cards
C. Applications
1. Teletypewriter
2. Billing machines with tape attachment
3. Typing of form letters
4. Cash registers with tape attachment

- D. Channel codes
  - 1. 5-, 6-, 7-, or 8-channel tape
  - 2. Codes are in channels that run the length of the tape
  - 3. Machines read the punches across the tape
  - 4. Solid row of small holes are not in a channel - it is the row in which the sprockets fit that drive the tape
  - 5. The channel codes are also called binary codes
- E. Checking accuracy
  - 1. Tape itself cannot be checked easily
  - 2. Have tape produce a hard copy and check hard copy for accuracy of tape

V. Integrated Data Processing - IDP
- A. Routines are simplified and office forms are designed and coordinated with machines that will process data automatically
- B. Once in tape form the data can be processed with a minimum of effort
- C. The original record punched into the tape serves all subsequent applications

VI. Edge-punched cards
- A. Use same channel codes as tape
- B. Can be stored easier than tape

VII. Other input media
- A. Magnetic tape
- B. Magnetic ink

VIII. Input media converters
- A. Tape to card
- B. Card to tape

IX. Input media reproducers
- A. Card to card
- B. Tape to tape

X. Study Guide 4

XI. Complete Projects 6 and 7

UNIT 5 - PROCESSING DATA BY THE TABULATING SYSTEM

I. Two systems of processing data
- A. Tabulating system
- B. Electronic computer system

II. Steps in the tabulating system
- A. Prepare source documents
  - 1. Purchase orders
  - 2. Time tickets
  - 3. Invoices
- B. Punch information into cards or tape

- C. Sort the data according to the particular information needed
- D. Summarize and tabulate information - computations are made
- E. Results are produced
  - 1. Printed report
  - 2. Summary-punched card
  - 3. Punched tape

III. Cause and effect
- A. Electric impulse
- B. Contact is made between brush and contact roller
  - 1. The roller carries the initial source of electricity
  - 2. The brush carries the electricity to complete a circuit and cause a result
- C. The machine cycle is timed
- D. Each position has a certain time value
  - 1. 1 = 1 time
  - 2. 4 = 4 time
  - 3. 12 = 12 time

IV. Sorting
- A. Machines used are the 082 or the 083 Sorter
  - 1. Operates at 650 cards per minute
  - 2. Sorts on one column at a time
- B. Three types of sorting
  - 1. Numerical
  - 2. Alphabetic
  - 3. Block
- C. Another method of classifying 3 types of sorting
  - 1. Sequencing - Arranging data in alphabetic or numeric order, either in ascending or descending order
  - 2. Grouping - process of arranging like items together, as a report showing sales by salesman. Grouping prepares data for reports in summarized form or for analysis of like data
  - 3. Selecting - Process of extracting a desired item or items or data from a larger file of data. Can easily be done without disturbing the sequence of the cards
- D. Operating principles
  - 1. Method of reading the card
  - 2. Method of carrying the cards to the pockets (chute blades)
- E. The operation
  - 1. Sorting one field
    - a. One column at a time
    - b. From right (units position) of field to the left
  - 2. Removing the cards from the pockets
    - a. From right to left putting each new pocket face down on top of the one to its right
    - b. Sight check cards from each pocket
- F. Alphabetic sorting
  - 1. Two sorts per column
  - 2. From right to left

- a. First on digit
- b. Second on zone

G. Numerical sorting
  1. One sort per column
  2. From right to left

H. Control sorting (minor, intermediate, and major fields)
  1. Explain minor, intermediate, and major fields
  2. Sort each field normally, first minor, then intermediate, then major field
  3. Example of fields and their classification of the major field

Major (District Number)	Intermediate (Office Number)	Minor (Salesman Number)
1 (Northeast Dist.)	1 (Boston)	52
		143
		177
	2 (NYC)	2
		17
		36
		79
		89
2 (Mid Coast Dist.)	1 (Baltimore)	3
		27
		41
		99
8 (Southwest Dist.)	1 (Dallas)	51
		58
	2 (El Paso)	56
		74

V. Collating
  A. Reports are usually prepared from more than one deck of cards
  B. Collating machines are 077, 085, 087, 088, and 089
  C. Functions
    1. Sequence check
    2. Select
    3. Merge
    4. Match

VI. Tabulating or Accounting Machine
  A. Common machines are the 402, 403, 407, and 419
  B. Machine functions
    1. Detail printing
    2. Accumulating

        3. Group printing
        4. Programming
        5. Summary punching
    C. Can print in 120 positions

VII. A special machine - a calculator - is available to perform calculations

VIII. The control panel
    A. Many machines get instructions from a control panel
        1. Accounting machine
        2. Calculator
        3. Reproducer
        4. Collator
        5. Interpreter
    B. The panel controls
        1. What data is to be used - it may use only certain fields
        2. What is to be done to the data, add, moved, etc.
        3. Where the data field is to be printed
        4. Skipping, printing zeros left, etc.
    C. The control panel must be rewired for each different function

IX. Programming
    A. Done by a programmer
    B. A program is a group of related routines that solve a given problem
    C. The program must be 100 per cent logical and detailed
    D. The program must be designed for the equipment available

X. Complete Study Guide 6

XI. Complete Project 8

UNIT 6 - THE TABULATING SYSTEM APPLIED TO SALES DATA PROCESSING

The main function of this unit is to show how information on one source document, the invoice, can be used to prepare several documents. The main thing to emphasize is that the information can be punched in a card, and the cards can be used for several reports. Sorting the data into different groups of information becomes important.

It would probably be best to follow the example in the text to show how this is done. Project 8 can be referred to to show how data can be processed in different ways.

Complete Study Guide 6.

Complete Project 9.

UNIT 7 - AN INTRODUCTION TO THE ELECTRONIC-COMPUTER SYSTEM

I. History of computers
   A. They are old - the abacus is one of the early computers
      17th Century - Blaise Pascal, 19, invented a gear-driven machine
   B. Electronic computers first used vacuum tubes
      In 1872 Steven Baldwin developed and sold a machine to Penn. RR - He found an error in a set of tables 7 men had worked out and checked for errors. He found 135 errors.
   C. Mechanical switches were replaced by electronic devices
   D. Storage units were added to existing computers
      1. Harvard Mark I - 1939
      2. Univac - 1951
      3. IBM - 1956
   E. The storage units or memory units allow data to be processed without rewiring the computer or using a different panel
   F. Modern computers are extremely fast
      1. Milleseconds - .001
      2. Microseconds - .000001
      3. Nanaseconds - .000000001 - the length of time it takes light to travel two feet. Light travels at the rate of 186,000 miles a second
      4. Pekoseconds - .000000000001

II. Types of computers
   A. Digital - solves problems by using digits
   B. Analog - measures and controls physical variables such as rotation, voltage, speed of sound, and air resistance

III. Chief aims of the computer systems
   A. To furnish data when they are needed
   B. To reduce operating costs

IV. Steps in a computer system
   A. Prepare source documents
   B. Prepare instructions - program
   C. Program is coded and put into input media
   D. Data and program are fed into the input unit where it is stored in the "memory" unit
   E. The data is processed by the control unit
   F. Computations are performed by the arithmetic unit of the computer
   G. The processed data are returned to the storage unit, where they remain for further processing or are read out of the computer
   H. The processed data are read out of the computer in the form of punched cards, paper tape, magnetic tape, or a printed document

V. Batch processing versus random processing
   A. Random processing can be done on a computer, but it is not usual
   B. Batch processing is usually done on the computer and becomes less complex than random processing. The instructions can be stated more simply

    1. Add a number to a balance and print the new balance
    2. Subtract an amount from a balance and print a new balance

VI. A computer installation is a system of machines - not a machine
  A. The storage unit
    1. Internal storage
      a. Magnetic drums
      b. Magnetic discs
      c. Magnetic cores
    2. External storage
      a. Punched cards
      b. Punched paper tape
      c. Magnetic tape
  B. The control unit
  C. The arithmetic unit
  D. Input media
    1. Punched card reader
    2. Paper tape reader
    3. Magnetic tape reader
    4. Console
  E. Output media
    1. Card punch
    2. Printer
    3. Console
    4. Paper tape punch
  F. Console
    1. Is basically an electric typewriter connected directly with the computer
    2. Is the device enabling the operator to maintain contact with the computer

VII. Binary code
  A. Has only 2 digits
    1. 0
    2. 1
  B. Is Base 2
  C. Each move to the left one digit doubles the value of the preceeding place - thus discuss place value
  D. The computer uses a binary-coded decimal system - not pure binary system
  E. A "bit" is one binary digit - BInary digiT
  F. The binary code concerns the inner workings of the computer

VIII. Complete Study Guide 7

IX. Complete Projects 10 and 11

UNIT 8 - PROCESSING DATA BY THE ELECTRONIC-COMPUTER SYSTEM

I. Computers process data in accordance with detailed instructions called programs

II. Programs are written by programmers

III. Two types of information are read into the computer and stored
   A. Data to be processed
   B. Program - a set of instructions
      1. Read a card
      2. Move data
      3. Add
      4. Subtract

IV. Computers are often referred to as stored program machines

V. Stored data
   A. Stored in computer memory
   B. Both numeric and alphabetic data may be stored
   C. BITs are stored in a cell (core)
   D. Stored as plus or minus electrical charge

VI. Memory
   A. One core can store one electrical charge
   B. A group of cores arranged in columns of rows is a plane - 5 rows of cores with 5 columns to each row includes 25 cores in 1 plane
   C. An arrangement of several planes stacked one on top of the other is called a module
   D. The memory unit of a computer contains one or more modules
   E. Each core has an address

VII. Computer abilities
   A. Store data
   B. Transfer data from one storage location to another
   C. Engage in logic
   D. Add, subtract, multiply, and divide numbers
   E. Punch out or print out results

VIII. A "word" is a single character or a group of characters representing a complete unit of information
   A. Instruction word
   B. Data word

IX. Addresses
   A. The address of a word is its lowest number for an instruction word
   B. The address of a data word is its highest number

X. Word marks identify the end of words

XI. Instruction format
   A. Operation code
   B. P address
   C. Q address

XII. The instruction formats given on pages 88 - 90 may be gone over together

XIII. Complete Study Guide 8

XIV. Complete Projects 12 and 13

UNIT 9 - PLANNING AN ELECTRONIC-COMPUTER PROGRAM

I. The placement of the steps in a program must be completely logical

II. The instructions must be precise

III. The program must be complete

IV. Steps in planning a program
   A. Define the problem
   B. Prepare the program steps to solve the problem
   C. Prepare a block diagram of the steps in the program
   D. Code and assemble the program
   E. Test the program
   F. Debug the program
   G. Run the program

V. The steps followed in a program in a logical representation in schematic form is a block diagram

VI. Languages
   A. Machine Language
   B. Symbolic Programming System - SPS
   C. Fortran

PART II - TEACHING MACHINE LANGUAGE PROGRAMMING FOR THE IBM 1620

Before a program can be run by the computer, it obviously must be read by or loaded into the computer. To do this we need a special program called a load routine to cause the program to be loaded. In the following example we will assume that we want our program begun in core storage location 00402.

LOAD ROUTINE

1. Press insert key
2. Type 360040200100 (Read numerically into 00402 data from the typewriter - 01 in the Q8-9 positions indicates the typewriter. See IBM 1620 Central Processing Unit, Model 1, p. 39.)
3. Type 4900402 (Branch to core address 00402.)
4. Release
5. Start

A PROGRAM TO READ DATA FROM THE TYPEWRITER AND TO WRITE OUT ON THE TYPEWRITER

1. 36 11111 00100 — Read numerically into 1111 from the typewriter (01)
2. 38 11111 00100 — Write numerically that which is in 11111. Write it on the typewriter.
3. 49 00402 R/S — Branch to 00402 to begin the program, release, start.
4. T2345‡R/S — This is data typed in on the typewriter beginning with a flag and ending with a record mark. The flag identifies the end of the field, and the record mark identifies the end of the record. The R/S is the release/start key on the typewriter. This releases the typewriter and allows your program to start.
5. Watch and wait!

Unless the operator returns the typewriter carriage, the data will be typed exactly where the carriage is. If you wish to have the data typed on the next line at the left margin, you can modify the program to do this by inserting one more instruction (34 00000 00102). This is a control instruction (34) which does not use a P address. In the Q address you identify the I/O device (Q8 and Q9 positions) and you specify the control function to be performed in Q11 (01 identifies the typewriter and 2 says to return the carriage). See CPU, p. 51 for Q11 control code.

To work this program, follow Load Routine (above), type instruction 1 of the program, and then add the new control instruction. Then continue.

The original program can be further modified to get the output on the printer instead of the typewriter. To do this, change the Q8-9 portion of the write instruction from 01 to 09 (09 identifies the printer.) Everything else in the program remains unchanged.

```
36 11111 00100
38 11111 00900
49 00402R/S
Numeric Data
```

To get the output on the paper tape punch, change the Q8-9 portion of the write instruction from 01 to 02.

```
36 11111 00100
38 11111 00200
49 00402R/S
Numeric Data
```

To get the output on the card punch, change the Q8-9 portion of the write instruction from 01 to 04. It is obviously necessary to have the card read/punch ready to operate. If the punch is not ready (turned on), the Punch/Disk Interlock light will be automatically turned on and will remain on until the punch is operative.

```
36 11111 00100
38 11111 00400
49 00402R/S
Numeric Data
```

Throughout these programs a branch instruction has been used. The Op Code for an unconditinnal branch is 49, its mnemonic being B. The

P address tells the computer to which address it should go, in this case to start our program. The Q address is not used in a branch (49) instruction.

Assignment: Read the IBM 1620 CPU, Model 1 (hereinafter referred to as CPU), pp. 39-42 and p. 30, the branch instruction (B-49).

In all of the above programs, the same basic program was used with the only modifications being the returning of the carriage and the changing of the output device. It is the purpose now to show further modifications of the same basic program by changing only the input device from the typewriter to the card reader and the paper tape reader.

Card Reader: To get the data into the machine from the card reader, change the read instruction (36) Q8-9 from 01 to 05. This instruction would then read: 36 11111 00500. The write instruction would remain unchanged. It is obvious that the Card Read Punch must be ready to read a card and that one or more cards be in the feed hopper.

Although the same load routine may be used, there is a much easier way to load this program. Instead of typing in the load routine, much work may be omitted by depressing the Reset button, placing the cards in the card read stacker, and depressing the Load button on the Card Read Punch. The Load button does two things: (1) It sets the Memory Address Register to zero, and (2) it reads one card in the numeric mode.

Paper Tape Reader: If the Q8-9 positions of the read instruction are 03, the program will be loaded from the paper tape reader. The initial load routine will have to be used to contact the paper tape reader.

There are, of course, many combinations that can be used that have not been presented:

Input Media	Output Media
Paper Tape	Paper Tape
Card	Card
Papet Tape	Printer
Paper Tape	Card
Card	Printer
Card	Paper Tape

If the student has not previously experimented with these various combinations, it is recommended that he does so as soon as possible.

The only type of data that has been used so far has been numeric. The next step is to change from numeric data to alphameric data. To read alphamerically, the Op Code should be 37 (it was 36 for numeric). To write alphameric, the Op Code should be 39 instead of the numeric write Op Code 38. When running these programs using the alphameric Op Codes (37 and 39), be sure to have both alpha data and numeric data in your material to check to see if everything is working as you intend.

Read: CPU, p. 42.

Dumping: To assist in understanding better the console, the student should now instruct the computer to dump some information previously stored in core. The Op Code is 35, mnemonic DN, and the P address is used to tell the computer where to begin in core. Transmission may be terminated by pressing the Release key on the 1620 console. While dumping data, use should be made of the Single Cycle Execute key (SCE). (See page 56 of the CPU.) Observation of the Memory Address Register should be made to determine what is being shown (See page 60 and 79, CPU.) If the Memory Address Register Display Selector is set at IR-1, the address of the next instruction will be shown in the Memory Address Register if the machine is stopped with the Stop key or a Halt instruction. Watch the Memory Address Register change as the SCE button is depressed. Try to determine what the array of lights means. At the same time the student should observe the Memory Data Register (CPU, p. 59) and the Memory Buffer Register. A good exercise for observing this register is to dump the Add Table. This table should be dumped 10 digits at a time. The steps in dumping the Add Table on the typewriter are: (1) Reset, (2) Insert, (3) 35 00300 00100, (4) Carriage Return, (5) press Release key, (6) push Start key, (7) push SCE button when 10 digits have been typed. If less than 10 have been typed, one more will be typed each time the SCE key is pushed. (8) Return the carriage, (9) press Start key, and (10) continue steps 6 through 8 until the 10 lines of the Add Table have been dumped.

Assignment: Dump the Multiply Table. (Instructor's note: The instruction will be 35 00100 00100.)

Assignment: (1) Write and run a program to read numerically on any input device and to print alphamerically on the printer. Be sure to include both numeric and alphameric data. (2) Write and run a program to read alphamerically on ony input device and to print numerically on the printer. In both program 1 and program 2, what happens, and why does it happen this way?

Instructor's note: If data were read in alphamerically and printed out numerically, no errors would be noted. You would get the same thing you would have gotten had you dumped. You would get the numeric array of what was stored in core. Since alphameric data required two storage locations, you would get the Hollerith code printed; i.e., A would print 41, B would print 42, etc. Numeric data from your input would print normally.

If data were numeric and the output alphameric, you would get a lot of garbage.

Arithmetic Instructions: Read pages 12-16 CPU. Read Transmit Digit Immediate, p. 34, and p. 51, Set Flag and Clear Flag.

Add (A-21) - With this instruction, the data in the field at the Q address is added to the data stored in the field at the P address. The sum replaces the data at the P address, but the data at the Q address remains unchanged.

With the instruction 21 01012 01593, the data at core location 01593 is added to the data located at core address 01012 and the sum is now stored at 01012.

Assume that you have two numbers punched into a card. Each contains 5 digits. The first one begins at card column 1 and the second begins in card column 21. The problem is to read this card, add the two numbers, and print the sum. The program would be:

```
36  RN   00402  00500
32  SF   00402
21  A    00406  00426
33  CF   00402
15  TDM  00407  00000
38  WN   00402  00900
49  B    00000
```

Each instruction of this program may be typed on a separate card; or, since all instructions total less than 80 card columns, the entire program may be typed into one card. If only one card is punched for the program, it is known as a one-card program. The data you run must have an answer of not more than five digits (anything more than five digits is known as an overflow). If you do have a sum of more than five digits, you will lose the high-order digit of the sum or, in other words, you will lose the overflow. The program will not stop. If you wish to have the computer halt if there is an overflow, this can be controlled by the arithmetic check switch. There is also an arithmetic check light that will come on if there is an overflow. See pages 58 and 59 of CPU.

With the arithmetic check switch to stop, upon the overflow, the machine reverts to the manual mode with the op code still in the op register. If you push Start, you continue. The overflow is lost. The arithmetic check light is still on, and the program will run until the next overflow even though the light remains on.

If the arithmetic check switch is on program rather than stop, the light merely comes on as a result of the overflow; but the computer does not halt; and you still lose the overflow.

Assignment: Punch this add program and experiment with and without an overflow and with the arithmetic check switch to program and to stop.

It is possible to enter only one instruction per card, or you can enter the entire program in one card if it does not contain more than 6½ instructions. A half instruction is one that does not use the Q address. This must be the last instruction. If you have a one-card program, it is unnecessary to have a load routine; because the load button on the card reader resets the Memory Address Register to zero and reads one card.

Assignment: Read CPU, p. 34, Transmit Digit and p. 32, Branch No Record Mark.

There are several ways to write a load routine. Following is an add program similar to the previous one but written with different instructions:

```
36  RN   00402  00500
32  SF   00402
32  SF   00422
21  A    00406  00426
33  CF   00402
25  TD   00407  00400
38  WN   00402  00900
49  B    18000
‡
```

Since this program has more than 6½ instructions, it cannot be punched into one card; therefore, punch one instruction per card. It is possible to enter six instructions per card, but for this problem we want only one instruction per card.

We would like to have this program entered in core storage location 18000. Our data will be entered at 00402. Therefore, a load routine is necessary. One that will do what we want is:

```
36  RN   1̄8000  00500
45  BNR  00036  00006̄
49  B    18000
11  AM   00006  0̄0012
49  B    00000
```

This can be punched into one card and must preceed your add program. The first instruction says to read the first program card into core storage address 18000 from the card reader. Then branch to 00036 if there is no record mark at 00006. If there is no record mark at 00006, go to 00036 and there is the fourth instruction of this load routine which says to add immediate 12 to the field which is at 00006. This

4

refers back to the first read instruction, and at 00006 is the field $\bar{1}8000$. This then becomes $\bar{1}8012$. The next instruction is then executed and says to branch back to 00000. This will go back to the first instruction which in the machine now reads 36 $\bar{1}8012$ 00500 and loads the next card of your program. This continues until the last card of your program, which contains only a ‡ in column 1, is read. You then say branch no record mark; and, since there is a record mark there, you move to the third instruction in this load routine which says to branch unconditionally to 18000. At 18000 it finds your program, follows it, and processes your data.

Another program can be typed on the typewriter to load a program. It is:

```
36  RN   18000  00500
11  AM   00006  0̅0012
49  B
Push the release key
Push the reset key
Place data cards in card read stacker and type
49  B    18000R/S
```

When you have a program of many cards, this routine will load them. Your data must be loaded separately from your program. Before data is loaded, you must push the release key, then the reset key, and then type in the branch instruction. Then load your data.

Assignment: (A) Write an add program which will take care of an overflow. (B) Write an add program that will add 4 numbers located at card columns 1, 21, 41, and 61. Each field should include two columns.

After having studied the Subtract Instruction, write a program that will subtract a 5-digit field punched into CC 21-25 from the 5-digit field punched into CC 1-5.

Experiment and see what would happen if the remainder is a negative balance.

Multiplication: When multiplication is done manually, the product is computed from right to left. This agrees with the way the computer arrives at the product. With the Op Code 23, the field located at the P address will be multiplied by the field at the Q address. The product is then stored in the product area beginning at 00099 and working serially to the lower core-storage positions. The data in the P and Q addresses is not changed. Before the product is computed, the product area is automatically cleared to zero. Termination of the computation is caused by the flag in the high-order position of the Q address. A flag bit is automatically stored in the high-order position of the product. A negative product will be indicated by a flag in the units position of the product (position 00099). The number of digits in the product is equal to the sum of the digits in the fields at the P and Q addresses.

Since there is no place to set a record mark without disturbing the multiply table, the product should be transferred internally to a working area the programmer has set aside, place a record mark after the working area, and read out from there.

Assignment: Punch some data cards and run a multiply program. Experiment to see what would happen if the length of the data field were to be shortened or lengthened. Experiment with the multiplication of amounts including decimals.

Following is an example of a multiplication program with data to be in CC 1-2 and 21-25. Load the program into 18000.

```
36  RN   00402  00500
32  SF   00402
32  SF   00422
15  TDM  03000  0000≠
23  M    00403  00426
26  TF   02999  00099
33  CF   02993
38  WN   02993  00900
15  TDM  03021  0000≠
31  TR   02980  03001
49  B    18000
≠
```

Automatic Division: Read CPU, pp. 17-22.

Program: Divide a 5-digit number punched in CC 1-5 by a 2-digit number punched in CC 21-22.

```
36  RN   00402  00500
32  SF   00402
32  SF   00422
28  LD   00097  00406
29  D    00093  00423
15  TDM  00100  0000≠
33  CF   00091
38  WN   00091  00900
15  TDM  00100  00000
≠
```

Assignment: Experiment with the divide program. See what happens when you use negative numbers.

<u>Looping</u>: Many times there will be a desire to do one or more instructions more than one time. For example, it may be desirable to add the amounts on several cards and print the total instead of just reading two numbers from one card and printing the sum. There is a procedure called looping which will enable us to perform selected instructions as many times as we want. There are two problems: (1) How do we get into a loop, and (2) how do we get out of a loop?

Getting into a loop is easily done by a branch instruction. Assume that we want to total the amounts on eight cards and print the sum. After we have read the first card, we want to transmit the data from the input area to a working area. We can do this by adding from the input area to the work area. We then want to branch back to our read instruction and read another data card. Again we want to add this data which is in the input area to the data we read from the last card which is now in the work area. We continue reading, adding, and branching back until we have all of our eight data cards read in and added. We have easily gotten into our loop by our branch instruction.

Our problem now is to get out of the loop since we have read all of our eight data cards and added the amounts. We now want to stop branching back and we want to print the sum. To get out of the loop, we need some way to tell the computer when we have read our eight data cards. Otherwise the computer will continue reading in cards and adding the amounts to the sum in the work area. This, of course, would end in an incorrect answer. There are several ways to tell the computer when we have read the eighth card and that it should now print the sum. We will consider one of these ways.

There are many indicators on the 1620. One will indicate when a number is high positive. We have told the computer to branch to core storage address 18048 when the high positive indicator is on. The Q address of the branch instruction (BI, 46) is 01100. This indicates which indicator is to be used, and 11 stipulates the high positive indicator. We have set our counter to $\overline{0}8$ and will decrement it by one each time an amount has been read in and added. Then we tell the computer to check the high-positive indicator; and, if it is on (high positive), go back and read in another card. If the high-positive indicator is not on, the next instruction is to be executed. When the high-positive indicator is not on, it means that the eighth card has been read because the counter has been decremented from eight to zero. This will automatically get us out of the loop and the next part of the program will be executed.

The last instruction in this program uses another feature that should be discussed at this point. It is possible to write a program that will be so big that all of the core storage will be used. If this happens and there is still more program, it is possible to cut down on some of the core used by compressing the instructions. It will be noticed that this program needs a field of eight zeros to be used in the housekeeping operations. It will also be noticed that the last instruction, a branch instruction, has eight zeros in sequence (49 18000 00000). These zeros can be used by placing a flag over the P4 address thus making a field of eight zeros with a flag over the high-order position. This field could be transmitted exactly like a field you could have set aside specifically for the housekeeping operation. Since the Q address of a branch instruction is not used, it is possible to use these five positions for storage of data or for any other use we may desire. For example, we could use this for a 5-position counter if one is needed. This procedure, of course, must be used with caution. You must be sure that the Q-address portion of the instruction is not used.

A program to add 8 cards with 8 digits in the first 8 columns and to print the total. This demonstrates looping and compressing.

```
16 00650 0000̅8
32  00401
32  00501
26  00508 18143
36  00401 00500
15  00509 0000≠
21  00508 00408
12  00650 0000̅1
46  18048 01100
33  00501
38  00501 00900
49  180̅00 00000
≠
```

PART III - TEACHING SPS FOR THE IBM 1620

The 1620 computer will understand only machine language; however, the programmer may write in other languages which can be converted into machine language instructions. One such language is the Symbolic Programming System, commonly called SPS.

SPS is one of many assembler languages. Instead of using actual core addresses, a label is given to an instruction which will automatically be converted into a machine language address by the computer. These labels may be alphameric and should be descriptive of the instruction or the data. The label may consist of up to six alphameric characters beginning in card column 2. At least one of the characters must be alphabetic or one of the special characters =, /, ., or @.

Immediately following the label field four columns have been reserved for the operation code. In these four spaces you may place the actual numeric op code, or you may use a mnemonic code as described on pages 140-148 of the CPU. The programmers usually prefer the mnemonics to the absolute numeric op code.

Card columns 16-75 are used for operands and remarks. In this section will be listed the symbols for the P address and the Q address. In SPS it is possible to use three operands which may be followed by remarks. The first operand is the symbolic P address, the second is the symbolic Q address, and the third is known as the flag-setting operand. The third operand sets flags when the flags are to be set in the instruction itself. The operands and remarks must be separated by commas. If an operand is omitted, the comma must still be used. For example, if there are to be the first operand and remarks only, card columns 16-75 might include:

WORK,,,THE NAME OF THE P ADDRESS

This shows the first operand called WORK, a comma to separate it from the second operand (which is not used), another comma to separate the missing second operand from the missing third operand, and a comma to separate the missing third operand from the remarks. If only a symbolic P address is used with nothing following, it is unnecessary to use commas. Commas are used to separate and to show omission.

Sometimes the programmer may wish to make comments to identify his program or to make additional statements strictly for information. He may do so by preparing a comment card. This card is easily identifiable by the * in CC 6, the first position of the label section. He may then use CC 7-75 to make any comments he may wish. The computer will print these comments, but no machine language instruction is created.

SPS has divided the operands into three categories: declarative operations, imperative operations, and processor control operations. Read CPU, pp. 55-59. It is important to note the position each kind addresses, the number of positions used, and whether a flag is set or not. Also read pp. 64-65 of the CPU.

The first SPS program to be considered uses only five statements. The program is to duplicate a deck of cards which may contain either alphabetic or numeric data or both. We want a second deck of cards identical to the original deck. The program might be:

```
        DORG  2402
START   RACD  CARD
        WACD  CARD
        B     START
CARD    DAS   80
        DEND TO START
```

The first statement consists of a label, the op code, and one operand. The label and the operand are symbolic and may be called anything we desire as long as they meet the length requirement and follow the rules concerning special characters and alpha data. It is noticed that the first label is called START, which readily tells a machine operator or programmer that this is the beginning of the program.

The op code RACD is the mnemonic for read alphabetically a card.

The operand CARD will be the address of the data symbolically called CARD. A machine address will be generated for the label, START, and one for the P address symbolically called CARD. An op code 37 will be generated for the RACD. Any time a symbol is used in the operands section, it must also appear in the label section. The reverse is also true. Later in the program we will tell the computer to reserve space for CARD.

The next statement says to write alphamerically a card and the address of the field to be written (or punched) is called CARD.

After we have read a card and punched a card, we now tell the computer to branch back to START and read and punch another card. This will continue until all cards have been read and an identical card punched.

We must now tell the computer to reserve in storage a field symbolically called CARD. The DAS says that the computer is to define an alphameric symbol. This will automatically double the number of core positions we specify since an alpha character requires two core positions. The 80 says the field is 80 positions long. This statement will then reserve in core 160 positions, the address of which will be an odd address since an alpha character requires an even address and the next odd numbered address. With a DAS statement, length specified by the first operand is automatically doubled and the address of the field is the leftmost position of the field plus one.

The DORG statement instructs the processor to begin the program at the address specified by the first operand. This defines the origin of the program. This program will begin at core address 02402.

Punch this program into SPS cards and run it. Have the program to be printed on the printer before it is executed. Notice the machine language generated, and compare it with the SPS program.

Assignment: Modify this program to have the printer print a copy of the deck of cards instead of punching another deck of cards. See CPU, p. 147.

Further modify the original program to have the data on the cards typed.

For the next program, suppose that we want to gangpunch four cards each of a master deck. The program will be presented in both machine language and SPS so a comparison can be made thereby assisting the student in understanding better the SPS language.

```
START   TFM   COUNT,4,10         16  TFM  02475  0000̅4
        RACD  CARD               37  RA   02477  00500
PUNCH   WACD  CARD               39  WA   02477  00400
        SM    COUNT,1,10         12  SM   02475  0000̅1
        BI    PUNCH,1100         46  BI   02462  01100
        B     START              49  B    02402
COUNT   DS    2
CARD    DAS   80
        DEND  START
```

This program will be entered at 02402. The first instruction sets a counter to 04 and places a flag over the field so it is stored as 0̄4. A card is then read and punched. One is subtracted from the counter so it is decremented to 0̄3. We then branch to the punch instruction on the indicator. When the indicator has been decremented to 0̄0, we will not branch on the indicator so our program branches back to START, the beginning of the program. Another card is then read in and four cards punched like it.

Addition is accomplished in SPS in a manner similar to a machine language program - except that symbols are used instead of actual addresses. A program to add two 5-digit numbers follows. It is presented in both machine language and SPS so a comparison can be made. It will be noticed that some control instructions are included. Unless special instructions are given, the numbers will be typed out on the same line. This is not a practical arrangement for an addition problem; therefore, we will instruct the computer to type the first number, return the carriage on the typewriter, space once additionally on the typewriter, and then type the next number. This not only makes a better output arrangement, but it allows us to demonstrate some control statements.

```
        DORG  402
ZERO    DC    7,@                     0̄0        0000≠
SUM     DC    7,@                     0̄0        0000≠
START   RNCD  INPUT                   36  RNCD 00632  00500
        TD    INPUT+10,400            25  TD   00642  00400
        RCTY                          34  RCTY 00000  00102
        SPTY                          34  SPTY 00000  00101
        WNTY  INPUT+5                 38  WNTY 00637  00100
        SF    INPUT+5                 32  SF   00637  00100
        A     SUM-1,INPUT+9           21  A    00414  00641
        TD    INPUT+5,400             15  TDM  00637  0000≠
        RCTY                          34  RCTY 00000  00102
        SPTY                          34  SPTY 00000  00101
        WNTY  INPUT                   38  WNTY 00632  00100
        SF    INPUT                   32  SF   00632  00000
        A     SUM-1,INPUT+4           21  A    00414  00636
        RCTY                          34  RCTY 00000  00102
        CF    SUM-6                   33  CF   00409  00000
        WNTY  ZERO+1                  38  WNTY 00409  00100
        TR    SUM-6,ZERO-6            31  TR   00409  00402
        B     START                   49  B    00416  00000
INPUT   DSS   80                      ‡
        DEND  START
```

Perhaps it is desired to add some fields and print only the total. To do this we will assume that we want to add 16 five-digit numbers all punched into one card and print only the total. This is known as crossfooting. The machine language and SPS programs follow:

```
START   TF    TOTAL,ZERO              26        02564  02572
        TFM   FLAG+6,INPUT+1          16        02456  0̄2574
        TFM   ADD+11,INPUT+5          16        02497  0̄2578
        RNCD  INPUT+1                 36        02574  00500
FLAG    SF    INPUT+1,,2              32        0̄2574  00000
        AM    FLAG+6,5                11        02456  0̄0005
        BNF   FLAG,INPUT+76           44        02450  02649
ADD     A     TOTAL,INPUT+5,7         21        02564  0̄2578
        AM    ADD+11,5                11        02497  0̄0005
        BNR   ADD,ADD_11,11           45        02486  02497̄
        CF    TOTAL-6                 33        02558  00000
        PRN   TOTAL-6                 38        02558  00900
        B     START                   49        02402  00000
TOTAL   DC    7,0
        DC    1,@
ZERO    DC    7,0
INPUT   DSS   81
        DC    5,@
        DEND  START
```

The last SPS program to be considered is one to divide a 4-digit number punched into CC 1-4 by a 2-digit number punched into CC 6-7. Notice the use of descriptive symbols.

```
DATA    DS      81
PROD    DS      6,99
START   RNCD    DATA-80
        SF      DATA-80
        SF      DATA-75
        LD      PROD,DATA-77
        D       PROD-3,DATA-74
        TD      PROD+1,400
        CF      PROD-1
        CF      PROD-4
        RCTY
        WNTY    PROD-4
        TDM     100,0
        B       START
        DEND    START
```

PART IV - TEACHING FORTRAN PROGRAMMING FOR THE IBM 1620

Fortran is a language which avoids the problem of the length of a number and where it is stored. Fortran is oriented to the problem and not to the machine.

There are two kinds of numbers - those with decimals and those without. Fortran comes from the words FORmula TRANslation. The types of numbers are floating point and fixed point. Floating point has a decimal. Fixed point is the integer. You do not have to know anything about the 1620 or any computer specifically to program in Fortran. Each computer will have a Fortran compiler for it. The floating point and fixed point numbers are stored differently. The fixed point always stores the same amount of numbers each time. A floating point number might store like this: $\overline{2}5000000\overline{0}2$. This means that you should move from the beginning two places to the right and set a decimal. If the number were .0025, you would want to say: $\overline{2}5000000\overline{0}\overline{2}$. The flag over the units position indicates a negative, so you would move the decimal two places to the left and you would get .0025.

Fortran has variables. A variable in most Fortran decks is limited to 5 characters. A variable contains from 1 to 5 characters, one of which must be a letter. If the variable is to stand for a fixed point number, it must have I, J, K, L, M, or N (INteger) as the first character. In floating point, the first character must be one of the other letters of the alphabet - A through H, or O through Z. You may not use special characters in a variable.

Fortran uses equations. To add, just say A=B+C. To subtract, say A=B-C. To multiply, say A=B*C. The slash is used to indicate division -

A=B/C. These are Fortran equations. The part on the right side makes up the Fortran expression. You may not have a mixed mode in an expression. You may not say A=B+I, because A and B are floating point and I is a fixed point. A valid floating point expression would be B+C-2.+A/3. while a fixed point expression would be (I*J+J2-JOB)*3. The parentheses are used in Fortran exactly like they are used in Algebra. The order of Fortran arithmetic execution is: exponentiation, multiplication and division, and addition and subtraction. Anything within parentheses is executed first. You may not have a character against a parenthesis. You also may not have two signs against one another.

The first Fortran program we will examine is one to add two 5-digit numbers, type out both numbers, and type out the sum. A program for this is:

```
10  READ 20, IA, IB
20  FORMAT (I5, I5)
    NUM = IA + IB
    TYPE 30, IA, IB, NUM
30  FORMAT (I11/I11//I11///)
    GO TO 10
    END
```

The first instruction says to read instruction 20, the data being fixed point A and fixed point B. Statement 20 is a format statement which tells the picture of the data to be read. The I5 says that the data is fixed point fields 5 digits in length. The next instruction says to add the two fields together, then type statement 30, the data to be typed being fixed point fields IA, IB, and NUM. The format of these fields being 11 digits in length is fixed point. The slashes are control symbols telling the typewriter to return the carriage. Obviously this also spaces the paper vertically leaving blank lines between the items.

The 11 spaces for the data arranges the output so the numbers will end 11 spaces from the left margin. The GO TO 10 statement is the branch instruction. It directs the program back to statement 10. To inform the computer that all of the program has been read in, we have the END instruction. This program is then compiled and executed.

Suppose that there was a field in CC 1-6 that we wanted to add to the field in CC 21-26. There will be shown two ways to write this program. Since we are limiting our fixed point variable to seven digits in length, we must overcome this in order to skip the 14 spaces between the fields. To do this, we will divide the 14 spaces into two fields 7 digits in length. The program is:

```
*FANDK0807
10  FORMAT (I6,I7,I7,I6)
20  READ 10, NDATA,NBLANK,JBLANK,JDATA
    NSUM=0
    NSUM=NDATA+JDATA
    PRINT 30,NSUM
30  FORMAT (1H ,I7)
    GO TO 20
    END
```

Another way to get by the 14 blank spaces is to indicate that these are spaces by using X. The same program might look like this:

```
*FANDK0807
10  FORMAT (I6,14X,I6)
20  READ 10, NDATA,JDATA
    NSUM=0
    NSUM=NDATA+JDATA
    PRINT 30,NSUM
30  FORMAT (1H ,I7)
    GO TO 20
    END
```

The format statement is important to study. It tells three things: (1) the name of the data fields, (2) whether the fields are fixed point - I - or floating point - F -, and (3) the number of decimal points if floating point fields are used.

A program to subtract CC 7-12 from CC 1-6 with each field containing two decimals might be as follows:

```
*FANDK0908
10  READ 30,SUBT,SMIN
20  FORMAT (F6.2,F6.2)
    DIF=SUBT-SMIN
    TYPE 30, DIF
30  FORMAT (1H ,F8.2)
    GO TO 10
    END
```

After each of these programs, the student should punch cards for it and run the program. He should then try variations of the program. For instance, he should determine why F8.2 is the format in statement 30. What would happen if it were greater than or less than 8.2? Why does this FANDK differ from the preceeding program? What would happen if the FANDK were 0504?

Multiplication, like other calculations, is not as difficult in Fortran as it is in either machine language or SPS. A problem that would multiply CC 6-10 by CC 53-55 would be programmed as follows:

```
*FANDK1010
10  READ 20, TIMES,BY
20  FORMAT (5X,F5.3,42X,F3.3)
    PROD=TIMES*BY
    IPROD=PROD
    TYPE 30, IPROD
30  FORMAT (1H ,I10)
    GO TO 10
    END
```

The above program reads in in floating point mode and types out in the fixed point mode. The same problem reading in in floating point and typing out in floating point would change only the TYPE instruction. It would be: PRINT 30,PROD. This would print the floating point product.

A program to reproduce a deck 1 for 1 is a short program:

```
10  READ 20,NDATA
20  FORMAT (I80)
    SUM=1.
    PUNCH 20,NDATA
    GO TO 10
    END
```

There is a Fortran statement that enables us to compare. It is the IF statement. For example, in the statement IF(N1-N2)30,40,50, if the computation within the parentheses results in a negative remainder, go to statement 30. If the results equals zero, go to 40. If the result is positive, however, go to 50. This allows us to execute certain statements depending upon the results of the computation.

A program to demonstrate the use of the IF statement is one in which data field N1 is in CC 1-4 and data field N2 is in CC 5-8. We want typed the larger of these two fields. If they are equal, type either field.

```
*FANDK0807
10  READ 20, N1,N2
20  FORMAT (I4,I4)
    IF(N1-N2)30,30,50
30  TYPE 40, N2
40  FORMAT (I4)
    GO TO 10
50  TYPE 60, N1
60  FORMAT (I4)
    GO TO 10
    END
```

The DO Loop is another feature of Fortran. DO 50 I=1,30,7 says to do down to and including statement 50 with I equal to 1 until it is equal to 30 and count by 7. The first time I equals 1. The second time I equals 8 and will continue being incremented by 7 thus being 15, 22, 29, but will continue with the program when I has been incremented by another 7 to make I equal to 36. The last statement must not be an IF statement. If the last statement of a DO loop is a CONTINUE statement, your program will be safe.

In Part III a program was presented which would add 16 five-digit numbers. A Fortran program to do this follows:

```
*FANDK0807
   DIMENSION N(16)
10 READ 20, (N(I),I=1,16)
20 FORMAT (16I5)
   ISUM=0
   DO 30 I=1,16
30 ISUM=ISUM+N(I)
   PRINT 40, ISUM
40 FORMAT (1H ,I10)
   GO TO 10
   END
```

This program also uses a DIMENSION statement, one of the most powerful in Fortran. It tells the computer to reserve core storage for 16 fields the size of N. This keeps us from naming 16 different data fields. The first field is N1. It is then incremented by 1 and becomes N2. This will continue until the last field is N16. Our DO statement says to do 30 with I equal to 1 the first time and to continue until I equals 16 incrementing it by 1 each time.

There are, of course, many things not covered by this paper in connection with programming. However, it is hoped that the student could now further develop his programming abilities to include the more sophisticated programs.

ABSTRACT

OE-S-85-098

AN EIGHT WEEK SUMMER INSTITUTE TRAINING PROGRAM TO RETRAIN OFFICE EDUCATION TEACHERS FOR TEACHING BUSINESS ELECTRONIC DATA PROCESSING

Theodore A. Koschler

Miami-Dade Junior College
Miami, Florida

June 21, 1965 thru August 13, 1965

OBJECTIVES

The major objective of the institute was to assist in the development of the knowledge and skill essential for teaching specialized courses in preparatory curriculums in business electronic data processing under Federally supported Vocational and Technical Education Acts.

There is an acute shortage of teachers for business data processing involving the use of computers and peripheral equipment. Since regular pre-service teacher education programs have not been developed in this newly emerged field of instruction, the Summer Institute program was initiated in an effort to meet the nation-wide demand for teachers. Miami-Dade Junior College is one of five schools conducting these institutes; the others are as follows: Orange Coast College, Costa Mesa, California; Colorado State University, Fort Collins, Colorado; Holding Technical Institute, Raleigh, North Carolina; and Milwaukee Institute of Technology, Milwaukee, Wisconsin.

One of the purposes of this program was to determine if successful teachers in the field of office or business education could be retrained, through a series of specially designed summer courses, to teach in a field having some relationship to their previous experience.

This institute had ~~at least~~ these specific objectives.

1. To retrain teachers with a minimum of three years teaching experience in business or office education for teaching ~~of newly emerged~~ business electronic data processing, including computer programming.
2. To further develop suggested course material -- including course content, references, visual and other instructional aids -- suitable for use as patterns and guidelines for future programs.